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OF

Arts, Sciences, and Literature.

BY

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SINES.

SINE, or *Right Sine*, in *Trigonometry*, a right line drawn from one extremity of an arc, perpendicular to the radius drawn from the other extremity: or, the sine is half the chord of twice the arc.

Thus the line AD (*Plate I. Trigonometry, fig. 4.*) which is half the chord, AB , of the double arc AEB , is the right sine; or, simply, the sine of the arc AE .

SINE, *Whole*, *Sinus totus*, is the sine of the quadrant HE , or of 90° ; that is, the whole sine is the same with the radius HC .

SINE, *Verse*, is a part, ED , of the whole sine or radius intercepted between the right sine AD and the arc AE .

It is demonstrated, 1. That, the right sine AD being perpendicular to the radius EC , all sines drawn to the same radius are parallel to each other.

2. Since the arc AE is the measure of the angle ACE , and AI the measure of the contiguous angle ACI , and the quadrant HE the measure of the right angle; AD is also the right sine, and ED the verse sine, of the angles ACE and ACI , and the whole sine is the sine of the right angle.

3. Two angles contiguous, as ACE and ACI , have the same sine.

4. The sines of obtuse angles are the same with those of their complements to two right angles: or the sine of any angle, and the sine of its supplement, are the same; or the sines of arcs less than 90° , serve equally for arcs as much greater than 90° ; *i. e.* the sines of 80° and 100° , of 60° and 120° , &c. are respectively equal.

5. All sines of similar arcs have the same ratio to their radii.

6. In every triangle the sides are as the sines of the opposite angles.

SINE-Complement, or *Cofine*, is the sine of an arc AE , which is the complement of another arc AH , to a quadrant.

Thus also the sine of the arc AH is called the *sine-complement* of the arc AE . And it is plain, that the *verse sine* and *cofine*, taken together, are equal to the radius.

The sine DE (*fig. 10.*) and the *verse sine* AE , being given in common measure, not in parts of the radius, to find the arc DA in degrees. Find the semidiameter AC : then in the triangle DEC , besides the right angle E , by the sides DE and DC we find the angle ECD (ACD), which shews the number of degrees in the arc DA ; the double of which is the arc DAD . This problem is of use in finding the segment of a circle. See **SEGMENT**.

Arithmetic of Sines is a term commonly employed to denote what is perhaps more properly called *analytical trigonometry*, being a modern branch of the analytical calculus, which we owe in a great measure to the celebrated Euler, though the principal geometrical theorem on which it is founded was first pointed out by Mayer, in a memoir published in the *Acta Petro.* for 1727; but the extension of the method, and a suitable mode of notation, are undoubtedly due to Euler.

The object of this branch of science is to exhibit the relations of the sines, cosines, tangents, cotangents, &c. of arcs, multiple arcs, &c.; and it is, without doubt, owing, in some measure, to the facilities this calculus has afforded, of expressing in a simple manner formulæ, which, without its aid, would have exceeded the powers of the human mind, that astronomy, which depends so much on these relations, has attained its present high degree of perfection.

In common arithmetic, our object is to combine together different simple numbers, by addition, multiplication, &c.;

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or to decompose them by the reverse operations of subtraction, division, or evolution; and the rules for all these cases are plain and direct, because the units of the several parts are equal and identical. But after we quit this species of calculation, we are no longer able to proceed with the same facility; the quantities we have to combine are only the representatives of others, and have no longer the same relation with each other; whatever we fix upon as an unit, it will not have to its representative the ratio of number to number, and consequently different modes of operation then become necessary. The first case of this kind occurs in the theory of logarithms, or, as it may be called, logarithmic arithmetic. Here, if we add two quantities together, *viz.* two logarithms, the sum thus obtained does not represent a quantity that is equal in value to the two quantities; because neither of the two original logarithms, nor that which is obtained by the addition of them, are quantities connected with our research, otherwise than as they are the representatives of certain numbers, whose relation or connection is sought; and the combinations, therefore, of these artificial numbers have not the same relation with each other as those they are taken to represent. If, for example, we have given the log. a , and wish to find the log. of $3a$, we cannot, as in simple arithmetic, call the latter $3 \log. a$, but $\log. 3 + \log. a$; so also, in trigonometry, if we have given the sine a , and wish from thence to find the sine $3a$, we can neither find it by multiplication, as in arithmetic; nor by addition, as in logarithms; but must proceed in a manner wholly different from either: and this process, (which we will now endeavour to illustrate) is what is here to be understood by the arithmetic of sines.

The notation used in this calculus is very simple, being as follows; *viz.* a being any angle, we denote

the sine of a , by $\sin. a$
 the cosine of a , by $\cos. a$
 the sine of $2a, 3a, \dots$ } by $\sin. 2a, \sin. 3a,$
 $4a, \dots n a,$ } $\sin. 4a, \dots \sin. n a$
 the cosine of $2a, 3a, \dots$ } by $\cos. 2a, \cos. 3a,$
 $4a, \dots n a,$ } $\cos. 4a, \dots \cos. n a$

In a similar manner,

the tangent of a is denoted by $\tan. a$
 the cotangent of a , by $\cot. a$
 the secant of a , by $\sec. a$
 the cosecant of a , by $\csc. a$
 the versed sine of a , by $\text{vers. } a$

And the several multiples of these in the same manner as above explained for the sines and cosines; thus the tangent, secant, cosecant, &c. of $2a, 3a, na, \dots$ are written $\tan. 2a, \sec. 3a, \csc. na, \dots$

Again, the powers of any of those lines are denoted by placing the index of the power over the name of the line; thus,

the square of the sine of a , by $\sin.^2 a$
 the cube of the cosine of a , by $\cos.^3 a$
 the cube of the tangent of a , by $\tan.^3 a$
 the n th power of the cotangent a , by $\cot.^n a$
 &c. &c. &c.

Having thus shewn the nature of the notation which is now universally adopted, it will not be amiss to say a few words relative to the value of the several trigonometrical lines, as the arc increases from 0 to the whole circumference; for though, in the more simple application of sines and cosines, as in the doctrine of plane trigonometry, we

have never to contemplate an arc greater than a semicircle; we have, in the more extended doctrine of sines, to consider angles of all possible magnitudes, and generally as functions of the arcs to which they correspond, or as general analytical expressions, whose values depend entirely on those of the arcs, and which may be of any magnitude. We have, therefore, frequently to treat of arcs, which it would be impossible to exhibit geometrically: and it is, therefore, of the highest importance to understand clearly the nature of the changes and variations which take place in the numerical values, and in the positions or signs of the different trigonometrical lines, while the arc increases from 0 to the whole circumference.

The value of these lines at certain determinate points, as at the 1st, 2d, 3d, and 4th quadrant, is absolutely necessary for laying the foundation of our analytical calculus; but with regard to the variation of position of those lines, which is analytically exhibited by a change of sign, we might dispense with it in this place, and depend wholly upon the deductions arising out of our general formulae: but as it is satisfactory to see the precise agreement between the analytical and geometrical mode of considering the subject, and as it will occupy but a few words, we shall trace the variation, both in sign and magnitude, of the sines and cosines through the first circumference, and afterwards shew the same from the analytical expressions. For this purpose, let $A B C D$ (*fig. 8.*) be a circle, having the several lines as exhibited in the figure, and suppose one of the extremities, as A , of an arc $A M$, to remain fixed, while the other extremity, M , passes successively over the circumference of the circle, through $C B D$, to A again.

Then, as the sine $M P$ continually recedes from A , till the point M arrives at B , and afterwards approaches towards A , on the other side of the diameter $A B$, till it is united with it again, it is evident that the sines of all arcs in the first semicircle have a different direction to those in the second, and we therefore consider the first as affirmative, or $+$, and the others as negative, or $-$.

It is also obvious that the sine $M P$ increases from 0, during the first quadrant $A C$, till at the end of it, it becomes equal to the radius; and that it decreases in the second quadrant to B , where it is again equal to zero. In the third quadrant it increases from B to D , where it is again equal to radius; but the signs being here negative throughout, it is equal to $- \text{rad.}$; after which it decreases till it arrives at A , where the sine is once more equal to 0.

In like manner, the cosine $O P$, being referred to the centre O , will become negative as often as it passes that point; and as this takes place both when the arc $A M$ becomes greater than $A C$, and when by its farther increase it is greater than $A B C D$, it is evident that the cosines of all arcs in the first and fourth quadrants are affirmative or $+$, and those of the second and third quadrants negative or $-$.

It is also obvious that the cosine $O P$ is equal to the radius, when the arc $A M$ is $= 0$, and that it continually decreases during the first quadrant $A C$; and at the end of it, becomes zero or 0. It then increases negatively during the second quadrant, and is at $B = - \text{rad.}$ It then decreases negatively in the third quadrant, and at D is again equal to zero. It then increases positively, till at A it is equal to radius, as before.

The same changes of sign will again obviously recur, both in the sine and cosine, if we suppose the radius $A M$ to pass a second, a third, &c. time over the circumference. We

SINES.

may, therefore, from what has been said, draw the following general conclusion. Let π be taken to represent the semi-circumference, and making rad. = 1; then,

$$\begin{aligned} \sin. 0\pi &= 0, & \sin. \frac{1}{2}\pi &= 1, & \sin. \pi &= 0, & \sin. \frac{3}{2}\pi &= -1, & \sin. 2\pi &= 0; \\ \cos. 0\pi &= 1, & \cos. \frac{1}{2}\pi &= 0, & \cos. \pi &= -1, & \cos. \frac{3}{2}\pi &= 0, & \cos. 2\pi &= 1. \end{aligned}$$

We may, on the same principles, demonstrate that

$$\begin{aligned} \tan. 0\pi &= 0, & \tan. \frac{1}{2}\pi &= \infty, & \tan. \pi &= 0, & \tan. \frac{3}{2}\pi &= \infty, & \tan. 2\pi &= 0; \\ \cot. 0\pi &= \infty, & \cot. \frac{1}{2}\pi &= 0, & \cot. \pi &= \infty, & \cot. \frac{3}{2}\pi &= 0, & \cot. 2\pi &= \infty; \\ \sec. 0\pi &= 1, & \sec. \frac{1}{2}\pi &= \infty, & \sec. \pi &= -1, & \sec. \frac{3}{2}\pi &= \infty, & \sec. 2\pi &= 1; \\ \operatorname{cosec}. 0\pi &= \infty, & \operatorname{cosec}. \frac{1}{2}\pi &= 1, & \operatorname{cosec}. \pi &= \infty, & \operatorname{cosec}. \frac{3}{2}\pi &= -1, & \operatorname{cosec}. 2\pi &= \infty. \end{aligned}$$

In addition to the preceding deductions, it may not be amiss to refer, in this place, to the relations subsisting between the different trigonometrical lines; but as these are mere simple analogies, which follow immediately from the

definitions themselves, it will, we presume, be deemed quite sufficient, if we exhibit them only, without going over the operations by which they are obtained. The most important of these are as follow, *viz.*

$$\begin{aligned} \sin. a &= \frac{\cos. a}{\cot. a} = \cos. a \cdot \tan. a = \sqrt{(1 - \cos.^2 a)} = \frac{1}{\sqrt{(1 + \cot.^2 a)}} = \frac{\tan. a}{\sqrt{(1 + \tan.^2 a)}} = \frac{1}{\operatorname{cosec}. a}; \\ \cos. a &= \frac{\sin. a}{\tan. a} = \sin. a \cdot \cot. a = \sqrt{(1 - \sin.^2 a)} = \frac{1}{\sqrt{(1 + \tan.^2 a)}} = \frac{\cot. a}{\sqrt{(1 + \cot.^2 a)}} = \frac{1}{\sec. a}. \end{aligned}$$

We may now establish our fundamental proposition, which, in words at length, may be stated thus.

Theorem.—The sine of the sum of two arcs is equal to the sum of the products of the sine of each, multiplied by the cosine of the other, divided by radius; or, according to our notation, in which we denote one arc by a , and the other by b , and make the radius = 1, it becomes

$$\sin. (a + b) = \sin. a \cdot \cos. b + \sin. b \cdot \cos. a.$$

Let AB (*fig. 9.*) represent the arc a , and AC the arc b ; BD and OD being the sine and cosine of the former, and AF and OF the sine and cosine of the latter; also BG the sine of the sum; we have to prove that

$$OA \cdot BG = BD \cdot OF + AF \cdot OD.$$

Draw DH parallel to OC, or perpendicular to BG; then the three right-angled triangles, HBD, ODE, OAF, are similar, and we have

$$AO : OF : BD : BH$$

$$\text{Also, } AO : OD : AF : DE \text{ or } HG.$$

Consequently,

$$OA \cdot BH + AO \cdot HG = BD \cdot OF + AF \cdot OD, \\ \text{or } OA \cdot BG = BD \cdot OF + AF \cdot OD.$$

And consequently, when the radius OA = 1, we have

$$\sin. (a + b) = \sin. a \cdot \cos. b + \sin. b \cdot \cos. a.$$

This one general formula would be sufficient for all our purpose, in establishing the doctrine of sines; but we prefer drawing also a second, as it follows immediately from the same principles as the above; *viz.*

$$\cos. (a + b) = \cos. a \cdot \cos. b - \sin. a \cdot \sin. b.$$

$$\text{For as } OA : AF :: BD : HD \text{ or } GE$$

$$OA : OF :: OD : OE;$$

therefore,

$$OA \cdot OE - OA \cdot GE = OF \cdot OD - AF \cdot BD, \\ \text{or } OA \cdot OG = OF \cdot OD - AF \cdot BD.$$

And when OA = radius = 1, this becomes

$$\cos. (a + b) = \cos. a \cdot \cos. b - \sin. a \cdot \sin. b.$$

If now we repeat these two, *viz.*

$$\begin{aligned} \sin. (a + b) &= \sin. a \cdot \cos. b + \sin. b \cdot \cos. a \\ \cos. (a + b) &= \cos. a \cdot \cos. b - \sin. a \cdot \sin. b; \end{aligned}$$

and multiply the first by $\cos. b$, and the second by $\sin. b$, and subtract the results, we shall have

$$\sin. (a + b) \cos. b - \cos. (a + b) \sin. b = \frac{\sin. a (\cos.^2 b + \sin.^2 b)}{\sin. a (\cos.^2 b + \sin.^2 b)};$$

or, since $\cos.^2 b + \sin.^2 b = 1$, this is

$$\sin. a = \sin. (a + b) \cdot \cos. b - \cos. (a + b) \sin. b.$$

If now we make $a + b = a'$, then $a = a' - b$, and we have $\sin. (a' - b) = \sin. a' \cos. b - \sin. b \cdot \cos. a'$, which is a third general formula.

Again, multiplying the first of the above formulæ by $\sin. b$, and the latter by $\cos. b$, and adding the results, we obtain

$$\sin. (a + b) \sin. b + \cos. (a + b) \cos. b = \frac{\cos. a (\cos.^2 b + \sin.^2 b)}{\cos. a (\cos.^2 b + \sin.^2 b)};$$

or, since $\cos.^2 b + \sin.^2 b = 1$,

$$\cos. a = \cos. (a + b) \cos. b + \sin. (a + b) \sin. b.$$

Or making $a + b = a'$, as above,

$$\cos. (a' - b) + \cos. a' \cos. b = \sin. a' \sin. b;$$

which is a fourth general formula.

In the two latter expressions we have used a' for a ; but it is obvious that this was merely for the sake of distinction, and that it is not necessary to retain it in our future operations.

These four formulæ being the foundation of the whole calculus of sines, we shall repeat them here in a connected order, whereby their analogy and relation will be more readily discovered; it will also be convenient for the sake of reference.

$$\begin{aligned} 1. \sin. (a + b) &= \sin. a \cdot \cos. b + \sin. b \cdot \cos. a \\ 2. \cos. (a + b) &= \cos. a \cdot \cos. b - \sin. a \cdot \sin. b \\ 3. \sin. (a - b) &= \sin. a \cdot \cos. b - \sin. b \cdot \cos. a \\ 4. \cos. (a - b) &= \cos. a \cdot \cos. b + \sin. a \cdot \sin. b \end{aligned} \quad (1).$$

Or they may be reduced to two, by means of the double sign \pm , thus:

1. $\text{fin. } (a \pm b) = \text{fin. } a \cdot \text{cof. } b \pm \text{fin. } b \cdot \text{cof. } a.$
2. $\text{cof. } (a \pm b) = \text{cof. } a \cdot \text{cof. } b \mp \text{fin. } a \cdot \text{fin. } b.$

In order to find similar formulæ for the tangents, cotangents, secants, cosecants, &c. we may put our second expression under the form,

$$\text{cof. } (a \pm b) = \left(1 \mp \frac{\text{fin. } a \cdot \text{fin. } b}{\text{cof. } a \cdot \text{cof. } b} \right) \text{cof. } a \cdot \text{cof. } b.$$

And if now we divide formula 1 by this, we have, by observing that $\frac{\text{fin. } a}{\text{cof. } a} = \tan. a,$

3. $\tan. (a \pm b) = \frac{\tan. a \pm \tan. b}{1 \mp \tan. a \cdot \tan. b}.$

4. $\cot. (a \pm b) = \frac{\cot. a \cdot \cot. b \mp 1}{\cot. b \pm \cot. a};$

the latter being obtained by dividing the second formula by the first.

Again, taking the reciprocal of formula 2, we have

$$\frac{1}{\text{cof. } (a \pm b)} = \frac{1}{1 \mp \tan. a \cdot \tan. b} \cdot \frac{1}{\text{cof. } a \cdot \text{cof. } b}; \text{ or,}$$

5. $\text{sec. } (a \pm b) = \frac{\text{sec. } a \cdot \text{sec. } b}{1 \mp \tan. a \cdot \tan. b}.$

6. $\text{cof. } (a \pm b) = \frac{\text{cosec. } a \cdot \text{cosec. } b}{\cot. b \pm \cot. a}.$

In like manner may be found,

7. $\text{cho. } (a \pm b) = \text{cho. } a \cdot \text{sup. cho. } b \pm \text{cho. } b \cdot \text{sup. cho. } a.$

8. $\text{verf. } (a \pm b) = \sqrt{\text{verf. } a \cdot \text{sup. verf. } b} \pm \sqrt{\text{verf. } b \cdot \text{sup. verf. } a}.$

The reader will find a different investigation of these properties under the article *Geometry of POSITION*.

Let us now see how far these general formulæ will indicate the changes of signs in the trigonometrical lines, as connected with the several different magnitudes of their respective arcs; a subject that we have already considered geometrically.

Let π denote the semicircle, and let the arc $a = \frac{1}{2}\pi$; then because $\text{fin. } \frac{1}{2}\pi = 1,$ and $\text{cof. } \frac{1}{2}\pi = 0,$ we have from

- Formula (1) $\text{fin. } (\frac{1}{2}\pi + b) = + \text{cof. } b.$
- (2) $\text{cof. } (\frac{1}{2}\pi + b) = - \text{fin. } b.$
- (3) $\text{fin. } (\frac{1}{2}\pi - b) = + \text{cof. } b.$
- (4) $\text{cof. } (\frac{1}{2}\pi - b) = + \text{fin. } b.$

Here we obtain the same results as before deduced; that is, it is obvious from these, that if we consider the sine and cosine of an arc less than a quadrant as positive quantities, the cosine of an arc greater than a quadrant, but less than a semicircle, will be negative, but its sine positive.

Again, let the arc $a = \pi$; then because $\text{fin. } \pi = 0,$ $\text{cof. } \pi = -1,$ we have

$$\begin{aligned} \text{fin. } (\pi + b) &= - \text{fin. } b; & \text{cof. } (\pi + b) &= - \text{cof. } b; \\ \text{fin. } (\pi - b) &= + \text{fin. } b; & \text{cof. } (\pi - b) &= - \text{cof. } b. \end{aligned}$$

Whence it follows, that the sines of angles greater than a semicircle, but less than a circle, have negative signs; while

those that are less than a semicircle are positive: whereas the cosines of angles equally above and below the semicircle have the same signs.

If now we assume the arc $a = \frac{3}{2}\pi$; then, because $\text{fin. } \frac{3}{2}\pi = -1,$ and $\text{cof. } \frac{3}{2}\pi = 0,$ we have

$$\begin{aligned} \text{fin. } (\frac{3}{2}\pi + b) &= - \text{cof. } b; & \text{cof. } (\frac{3}{2}\pi + b) &= + \text{fin. } b; \\ \text{fin. } (\frac{3}{2}\pi - b) &= - \text{cof. } b; & \text{cof. } (\frac{3}{2}\pi - b) &= - \text{fin. } b. \end{aligned}$$

Therefore, when the arc is comprehended between $\frac{3}{2}\pi, 2\pi,$ its cosine is positive, and its sine negative. These results have all been previously established geometrically; but they are here very readily extended to any arcs expressed by

$\frac{n}{2}\pi \pm b;$ n being any number whatever. These are all contained in the following general formulæ, *viz.*

$$\text{fin. } \left(\frac{4n+1}{2}\pi \pm b \right) = + \text{cof. } b.$$

$$\text{fin. } \left(\frac{4n+2}{2}\pi \pm b \right) = \mp \text{fin. } b.$$

$$\text{fin. } \left(\frac{4n+3}{2}\pi \pm b \right) = - \text{cof. } b.$$

$$\text{fin. } \left(\frac{4n+4}{2}\pi \pm b \right) = \pm \text{fin. } b.$$

$$\text{cof. } \left(\frac{4n+1}{2}\pi \pm b \right) = \mp \text{fin. } b.$$

$$\text{cof. } \left(\frac{4n+2}{2}\pi \pm b \right) = - \text{cof. } b.$$

$$\text{cof. } \left(\frac{4n+3}{2}\pi \pm b \right) = \pm \text{fin. } b.$$

$$\text{cof. } \left(\frac{4n+4}{2}\pi \pm b \right) = + \text{cof. } b.$$

Hence it follows, that there is an indefinite number of arcs that have the same sine and cosine, as also the same secant and tangent; the conditions of which latter are readily deduced from the above, by means of the formula

$$\tan. a = \frac{\text{cof. } a}{\text{fin. } a}, \quad \cot. a = \frac{\text{fin. } a}{\text{cof. } a}, \quad \text{sec. } a = \frac{1}{\text{cof. } a}, \quad \&c.$$

For since $\tan. a = \frac{\text{fin. } a}{\text{cof. } a},$ and $\cot. a = \frac{\text{cof. } a}{\text{fin. } a},$ it fol-

lows, that the tangent will be positive, while $\text{fin. } a$ and $\text{cof. } a$ have the same signs; and negative, when the signs are different; and the same also with the cotangents: these are, therefore, both positive in the first and third quadrants, and negative in the second and fourth. Also the tangent is infinite when the $\text{cof.} = 0,$ and cotangent infinite when

$\text{fin.} = 0.$ Again, since $\text{sec. } a = \frac{1}{\text{cof. } a},$ and $\text{cosec. } a = \frac{1}{\text{fin. } a},$

it follows that these lines have the same signs as the cof. and fin. respectively; and that the secant is infinite when $\text{cof.} = 0,$ and the cosecant infinite when $\text{fin.} = 0.$

Having thus shewn the relations between the several trigonometrical lines, their mutations and determinate values, under certain magnitudes of the arcs to which they appertain, we shall proceed in the next place to investigate some of the principal formulæ for the sines, cosines, &c. of multiple arcs.

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Of Multiple Arcs.

By referring to our formula (I), we have

$$\sin. (a + b) = \sin. a \cdot \text{cof. } b + \sin. b \cdot \text{cof. } a;$$

which, by writing $(n - 1) a$ for a , and a for b , becomes

$$\sin. n a = \sin. (n - 1) a \cdot \text{cof. } a + \text{cof. } (n - 1) a \cdot \sin. a.$$

By substituting in this formula for $\sin. (n - 1) a$, and $\text{cof. } (n - 1) a$, under the form

$$\begin{aligned} & \sin. \left\{ (n - 2) a + a \right\} \text{ and } \text{cof. } \left\{ (n - 1) a + a \right\}, \text{ we obtain} \\ \sin. n a = & \left\{ \sin. (n - 2) \cdot \text{cof. } a + \text{cof. } (n - 2) a \cdot \sin. a \right\} \text{cof. } a \\ & + \left\{ \text{cof. } (n - 2) a \cdot \text{cof. } a - \sin. (n - 2) a \cdot \sin. a \right\} \sin. a \end{aligned}$$

Substituting here again for $(n - 2) a$, under the form $(n - 3) a + a$, and observing that the second term of the first line is the same as the first of the second, we have

$$\begin{aligned} \sin. n a = & \left\{ \sin. (n - 3) a \cdot \text{cof. } a + \text{cof. } (n - 3) a \cdot \sin. a \right\} \text{cof.}^2 a \\ & + 2 \left\{ \text{cof. } (n - 3) a \cdot \text{cof. } a - \sin. (n - 3) a \cdot \sin. a \right\} \text{cof. } a \cdot \sin. a \\ & - \left\{ \sin. (n - 3) a \cdot \text{cof. } a + \text{cof. } (n - 3) a \cdot \sin. a \right\} \sin.{}^2 a \end{aligned}$$

$= \sin. (n - 3) a \cdot \text{cof.}^3 a + 3 \text{cof. } (n - 3) a \cdot \text{cof.}^2 a \cdot \sin. a - 3 \sin. (n - 3) a \text{cof. } a \cdot \sin.{}^2 a - \text{cof. } (n - 3) a \cdot \sin.{}^3 a$;
the last term of each of those lines being still the same as the first term of the following; and therefore, without pursuing the operation any farther, the law of continuation is obvious; *viz.* the several coefficients will be exactly those of the binomial; but the signs will be two *plus* and two *minus* alternately, whence generally

$$\sin. n a = \sin. (n - m) a \cdot \text{cof.}^m a + A \text{cof. } (n - m) a \cdot \text{cof.}^{m-1} a \sin. a - B \sin. (n - m) a \cdot \text{cof.}^{m-2} a \sin.{}^2 a - C \text{cof. } (n - m) a \text{cof.}^{m-3} a \cdot \sin.{}^3 a + \&c.$$

where A, B, C, &c. are the coefficients of $(1 + 1)^m$.

And exactly in the same manner, we find

$$\text{cof. } n a = \text{cof. } (n - m) a \cdot \text{cof.}^m a - A \sin. (n - m) a \text{cof.}^{m-1} a \sin. a - B \text{cof. } (n - m) a \cdot \text{cof.}^{m-2} a \cdot \sin.{}^2 a + C \sin. (n - m) a \cdot \text{cof.}^{m-3} a \cdot \sin.{}^3 a + \&c.$$

In these formulæ m is indeterminate, and may be assumed at pleasure; let us therefore take $m = n$, and we have

$$\sin. n a = A \text{cof.}^{n-1} a \cdot \sin. a - C \text{cof.}^{n-3} a \cdot \sin.{}^3 a + E \text{cof.}^{n-5} a \cdot \sin.{}^5 a - \&c. \quad (\text{II.})$$

and

$$\text{cof. } n a = \text{cof.}^n a - B \text{cof.}^{n-2} a \cdot \sin.{}^2 a + D \text{cof.}^{n-4} a \cdot \sin.{}^4 a - \&c. \quad (\text{III.})$$

where A, B, C, &c. represent the coefficients of $(1 + 1)^n$.

From these two general formulæ we readily deduce the following particular cases; *viz.*

1. $\sin. a = 1 \sin a$
2. $\sin. 2 a = 2 \text{cof. } a \cdot \sin. a$
3. $\sin. 3 a = 3 \text{cof.}^2 a \cdot \sin. a - \sin.{}^3 a$
4. $\sin. 4 a = 4 \text{cof.}^3 a \cdot \sin. a - 4 \text{cof. } a \sin.{}^3 a$
5. $\sin. 5 a = 5 \text{cof.}^4 a \cdot \sin. a - 10 \text{cof.}^2 a \sin.{}^3 a + \sin.{}^5 a$
- &c. = &c.

1. $\text{cof. } a = \text{cof. } a$
2. $\text{cof. } 2 a = \text{cof.}^2 a - \sin.{}^2 a$
3. $\text{cof. } 3 a = \text{cof.}^3 a - 3 \text{cof. } a \cdot \sin.{}^2 a$
4. $\text{cof. } 4 a = \text{cof.}^4 a - 6 \text{cof.}^2 a \cdot \sin.{}^2 a + \sin.{}^4 a$
5. $\text{cof. } 5 a = \text{cof.}^5 a - 10 \text{cof.}^3 a \cdot \sin.{}^2 a + 5 \text{cof. } a \cdot \sin.{}^4 a$
- &c. = &c.

These, it is obvious, may be continued at pleasure, the law of the coefficients being exhibited in the above general formulæ.

SINES.

In the formulæ of (II) and (III), the $\sin. a$ and $\cos. a$ both enter; but as $\sin.^2 a = 1 - \cos.^2 a$, we may, by substitution in the latter, express the $\cos. n a$ in terms of the $\cos. a$ only; but in the former, in consequence of the odd powers of the sine, we cannot exterminate either the $\sin. a$ or $\cos. a$ entirely; the simplest state of these formulæ, after the above substitution, is as follows; *viz.*

$$\sin. n a = \left\{ (2 \cos. a)^{n-1} - \frac{n-2}{1} (2 \cos. a)^{n-3} + \frac{(n-3)(n-4)}{1 \cdot 2} (2 \cos. a)^{n-5} \right. \\ \left. - \frac{(n-4)(n-5)(n-6)}{1 \cdot 2 \cdot 3} (2 \cos. a)^{n-7} + \&c. \right\} \sin. a \quad (\text{IV.})$$

$$\cos. n a = \frac{1}{2} \left\{ (2 \cos. a)^n - n (2 \cos. a)^{n-2} + \frac{n(n-3)}{1 \cdot 2} (2 \cos. a)^{n-4} \right. \\ \left. - \frac{n(n-4)(n-5)}{1 \cdot 2 \cdot 3} (2 \cos. a)^{n-6} + \&c. \right\} \quad (\text{V.})$$

From which the following particular cases are readily drawn, *viz.*

1. $\sin. a = 1 \sin. a$
2. $\sin. 2 a = 2 \cos. a \cdot \sin. a$
3. $\sin. 3 a = (4 \cos.^2 a - 1) \sin. a$
4. $\sin. 4 a = (8 \cos.^3 a - 4 \cos. a) \sin. a$
5. $\sin. 5 a = (16 \cos.^4 a - 12 \cos.^2 a + 1) \sin. a$
- &c. = &c.

1. $\cos. a = 1 \cos. a$
2. $\cos. 2 a = 2 \cos.^2 a - 1$
3. $\cos. 3 a = 4 \cos.^3 a - 3 \cos. a$
4. $\cos. 4 a = 8 \cos.^4 a - 8 \cos.^2 a + 1$
5. $\cos. 5 a = 16 \cos.^5 a - 20 \cos.^3 a + 3 \cos. a$
- &c. = &c.

If we refer again to our formula (I), *viz.*

$$\sin. (a + b) = \sin. a \cdot \cos. b + \sin. b \cdot \cos. a \\ \cos. (a + b) = \cos. a \cdot \cos. b - \sin. a \cdot \sin. b$$

we readily draw from these the following, *viz.*

$$\sin. (n + 1) a = \sin. n a \cdot \cos. a + \cos. n a \sin. a \\ \cos. (n + 1) a = \cos. n a \cdot \cos. a - \sin. n a \sin. a$$

Multiplying now the first by any indefinite quantity v , and adding it to the second, we obtain

$$\cos. (n + 1) a + v \sin. (n + 1) a \\ = \left\{ \begin{array}{l} (\cos. a + v \sin. a) \cos. n a \\ + (\cos. a - \frac{1}{v} \sin. a) v \sin. n a \end{array} \right.$$

Where, by taking for the indefinite quantity v , the particular value $\sqrt{-1}$, so that $v = -\frac{1}{v}$, these will become

$$\cos. (n + 1) a + v \sin. (n + 1) a = (\cos. a + v \sin. a) \cos. n a \\ (\cos. n a + v \sin. n a)$$

whence, making n successively = 1, 2, 3, &c. we obtain

$$\cos. 2 a + v \sin. 2 a = (\cos. a + v \sin. a)^2 \\ \cos. 3 a + v \sin. 3 a = (\cos. a + v \sin. a)^3 \\ \cos. 4 a + v \sin. 4 a = (\cos. a + v \sin. a)^4 \\ \cos. 5 a + v \sin. 5 a = (\cos. a + v \sin. a)^5 \\ \vdots \\ \cos. n a + v \sin. n a = (\cos. a + v \sin. a)^n \quad (\text{VI.})$$

If, instead of adding the two formulæ, after multiplying the first by v , we subtract the first from the second, we shall get

$$\cos. (n + 1) a - v \sin. (n + 1) a \\ = \left\{ \begin{array}{l} (\cos. a - v \sin. a) \cos. n a \\ - (\cos. a + \frac{1}{v} \sin. a) v \sin. n a \end{array} \right.$$

Where, by giving the same value, *viz.* $\sqrt{-1}$, to v , we have

$$\cos. (n + 1) a - v \sin. (n + 1) a \\ (\cos. a - v \sin. a) (\cos. n a - v \sin. n a)$$

and making again $n = 1, 2, 3,$ &c. we obtain

$$\cos. 2 a - v \sin. 2 a = (\cos. a - v \sin. a)^2 \\ \cos. 3 a - v \sin. 3 a = (\cos. a - v \sin. a)^3 \\ \cos. 4 a - v \sin. 4 a = (\cos. a - v \sin. a)^4 \\ \cos. 5 a - v \sin. 5 a = (\cos. a - v \sin. a)^5 \\ \vdots \\ \cos. n a - v \sin. n a = (\cos. a - v \sin. a)^n \quad (\text{VII.})$$

Whence by addition and subtraction, and establishing the value of v ,

$$\cos. n a = \frac{1}{2} \left\{ (\cos. a + \sqrt{-1} \cdot \sin. a)^n + (\cos. a - \sqrt{-1} \cdot \sin. a)^n \right\}$$

$$\sin. n a = \frac{1}{2 \sqrt{-1}} \left\{ (\cos. a + \sqrt{-1} \sin. a)^n - (\cos. a - \sqrt{-1} \sin. a)^n \right\}$$

If in these two formulæ we substitute $\cos. a = x$, $\sin. a = \sqrt{1 - x^2}$; then $\sqrt{-1} (\sin. a) = \sqrt{x^2 - 1}$, and we have

$$\cos. n a = \frac{1}{2} \left\{ (x + \sqrt{x^2 - 1})^n + (x - \sqrt{x^2 - 1})^n \right\}$$

$$\sin. n a = \frac{1}{2 \sqrt{-1}} \left\{ (x + \sqrt{x^2 - 1})^n - (x - \sqrt{x^2 - 1})^n \right\}$$

And assuming $x = y + \frac{1}{y}$, so that $x^2 - 1$ may be a complete square, or $\sqrt{x^2 - 1} = y - \frac{1}{y}$; these expressions reduce to

$$\cos. n a = \frac{1}{2} \left(y^n + \frac{1}{y^n} \right) \quad (\text{VIII.})$$

$$\sin. n a = \frac{1}{2 \sqrt{-1}} \left(y^n - \frac{1}{y^n} \right) \quad (\text{IX.})$$

From

SINES.

From which the following particular cases readily flow; which are the most elegant expressions we have for the sines and cosines of multiple arcs.

For a farther application of these formulæ to the doctrine of sines and cosines, see the article *Cotesian THEOREM*.

It may not be amiss to add, with regard to the history of the invention of these formulæ, that both the general and particular cases of the numbers (II) and (III) were first given by John Bernoulli, in the Leipzig Acts for 1701; those of numbers (IV) and (V) were published by Vieta, under the denomination *angular sections*; but he regarded them not as properties of sines and cosines, but as those of chords and their supplements, to which they are easily reduced. The other four formulæ, viz. (VI), (VII), (VIII), (IX), are all derived from a formula published by De Moivre in his "Miscellanea Analytica."

In order to investigate formulæ for the multiple tangents and cotangents, we may repeat here our formulæ (II) and (III); viz.

$$\begin{aligned} \sin. n a &= A \cos.^{n-1} a \sin. a - C \cos.^{n-3} a \sin.^3 a + E \cos.^{n-5} a \sin.^5 a - \&c. \\ \cos. n a &= \cos.^n a - B \cos.^{n-2} a \sin.^2 a + D \cos.^{n-4} a \sin.^4 a - \&c. \end{aligned}$$

where 1, A, B, C, &c. represent the coefficients of $(1 + 1)^n$.

Writing these under the form

$$\begin{aligned} \sin. n a &= \left\{ A \frac{\sin. a}{\cos. a} - C \frac{\sin.^3 a}{\cos.^3 a} + E \frac{\sin.^5 a}{\cos.^5 a} - \&c. \right\} \cos.^n a \\ \cos. n a &= \left\{ 1 - B \frac{\sin.^2 a}{\cos.^2 a} + D \frac{\sin.^4 a}{\cos.^4 a} - \&c. \right\} \cos.^n a \end{aligned}$$

and dividing the former by the latter, and observing that $\frac{\sin. a}{\cos. a} = \tan. a$; we have

$$\tan. a = \frac{A \tan. a - C \tan.^3 a + E \tan.^5 a - \&c.}{1 - B \tan.^2 a + D \tan.^4 a - \&c.} \quad (X.)$$

Or writing them under the form

$$\begin{aligned} \sin. n a &= \left\{ A \frac{\cos.^{n-1} a}{\sin.^{n-1} a} - C \frac{\cos.^{n-3} a}{\sin.^{n-3} a} + E \frac{\cos.^{n-5} a}{\sin.^{n-5} a} - \&c. \right\} \sin. n a \\ \cos. n a &= \left\{ \frac{\cos.^n a}{\sin.^n a} - B \frac{\cos.^{n-2} a}{\sin.^{n-2} a} + D \frac{\cos.^{n-4} a}{\sin.^{n-4} a} - \&c. \right\} \sin. n a \end{aligned}$$

and dividing the latter by the former, we have

$$\cot. n a = \frac{A \cot.^{n-1} a - C \cot.^{n-3} a + E \cot.^{n-5} a - \&c.}{\cot.^n a - B \cot.^{n-2} a + D \cot.^{n-4} a - \&c.} \quad (XI.)$$

From these we draw the following particular cases.

1. $\tan. a = \tan. a$	1. $\cot. a = \cot. a$
2. $\tan. 2 a = \frac{2 \tan. a}{1 - \tan.^2 a}$	2. $\cot. 2 a = \frac{\cot.^2 a - 1}{2 \cot. a}$
3. $\tan. 3 a = \frac{3 \tan. a - \tan.^3 a}{1 - 3 \tan.^2 a}$	3. $\cot. 3 a = \frac{\cot.^3 a - 3 \cot. a}{3 \cot.^2 a - 1}$
4. $\tan. 4 a = \frac{4 \tan. a - 4 \tan.^3 a}{1 - 6 \tan.^2 a + \tan.^4 a}$	4. $\cot. 4 a = \frac{\cot. 4 a - 6 \cot.^2 a + 1}{4 \cot.^3 a - 4 \cot. a}$
5. $\tan. 5 a = \frac{5 \tan. a - 10 \tan.^3 a + \tan.^5 a}{1 - 10 \tan.^2 a + 5 \tan.^4 a}$	5. $\cot. 5 a = \frac{\cot.^5 a - 10 \cot.^3 a + 5 \cot. a}{5 \cot.^4 a - 10 \cot.^2 a + 1}$
&c. = &c.	&c. = &c.

In order to obtain similar formulæ for the secants and cosecants, we must avail ourselves of the formulæ (IV) and (V), which may be written

$$\begin{aligned} \sin. n a &= \left\{ 2^{n-1} - \frac{n-2}{1} \cdot 2^{n-3} \frac{1}{\cos. a} + \frac{(n-3)(n-4)}{1 \cdot 2} \cdot 2^{n-5} \frac{1}{\cos.^3 a} - \&c. \right\} \cos.^{n-1} a \cdot \sin. a \\ \cos. n a &= \frac{1}{2} \left\{ 2^n - n \cdot 2^{n-2} \frac{1}{\cos.^2 a} + \frac{n(n-3)}{1 \cdot 2} \cdot 2^{n-4} \frac{1}{\cos.^4 a} - \&c. \right\} \cos.^n a \end{aligned}$$

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$$\text{or, } \sin. n a = \left\{ 2^{n-1} - \frac{n-2}{1} \cdot 2^{n-3} \sec.^2 a + \frac{(n-3)(n-4)}{1 \cdot 2} \cdot 2^{n-5} \sec.^4 a \right\} \frac{1}{\sec.^{n-1} a \cdot \text{cofec. } a}$$

$$\text{cof. } n a = \left\{ 2^{n-1} - n \cdot 2^{n-3} \sec.^2 a + \frac{n(n-3)}{1 \cdot 2} \cdot 2^{n-5} \sec.^4 a - \&c. \right\} \frac{1}{\sec.^n a}$$

The reciprocal of the latter gives,

$$\text{fec. } n a = \frac{\sec.^n a}{2^{n-1} - n \cdot 2^{n-3} \sec.^2 a + \frac{n(n-3)}{1 \cdot 2} \cdot 2^{n-5} \sec.^4 a - \&c.} \quad (\text{XII.})$$

And the reciprocal of the former,

$$\text{cofec. } n a = \frac{\sec.^{n-1} a \cdot \text{cofec. } a}{2^{n-1} - \frac{n-2}{1} \cdot 2^{n-3} \sec.^2 a + \frac{(n-3)(n-4)}{1 \cdot 2} \cdot 2^{n-5} \sec.^4 a - \&c.} \quad (\text{XIII.})$$

From these we draw the following particular cases :

1. $\text{fec. } a = \sec. a$	1. $\text{cofec. } a = \text{cofec. } a$
2. $\text{fec. } 2 a = \frac{\sec.^2 a}{2 - \sec.^2 a}$	2. $\text{cofec. } 2 a = \frac{\sec. a \cdot \text{cofec. } a}{2}$
3. $\text{fec. } 3 a = \frac{\sec.^3 a}{4 - 3 \sec.^2 a}$	3. $\text{cofec. } 3 a = \frac{\sec.^2 a \cdot \text{cofec. } a}{4 - \sec.^2 a}$
4. $\text{fec. } 4 a = \frac{\sec.^4 a}{8 - 8 \sec.^2 a + \sec.^4 a}$	4. $\text{cofec. } 4 a = \frac{\sec.^3 a \cdot \text{cofec. } a}{8 - 4 \sec.^2 a}$
5. $\text{fec. } 5 a = \frac{\sec.^5 a}{16 - 20 \sec.^2 a + 5 \sec.^4 a}$	5. $\text{cofec. } 5 a = \frac{\sec.^4 a \cdot \text{cofec. } a}{16 - 12 \sec.^2 a + \sec.^4 a}$
&c. = &c.	&c. = &c.

These latter formulæ have the same defect as those of the sines from which they are derived; *viz.* that both the secant and cofecant of the single arc enter in the general expression for the cofecant of the multiple arc.

We shall not investigate the formula for the multiple versed sine, but shall content ourselves with merely exhibiting the result, which is as follows :

$$\text{vers. } n a = n^2 \text{vers. } a - \frac{n-1}{2 \cdot 3} (A) \text{vers.}^2 a - \frac{n^2-2^2}{3 \cdot 5} (B) \text{vers.}^3 a - \frac{n^2-3^2}{4 \cdot 7} (C) \text{vers.}^4 a - \&c.$$

where A, B, C, &c. are the coefficients of the preceding terms.

A variety of other formulæ for multiple arcs might be here investigated, but our limits forbid a farther extension; those which we have given above are chiefly exhibited by means of the powers of the single arc; a few others, in the form of continued products, may be here enumerated, but we must not attempt their investigation.

Let π denote the semicircumference, and we shall have

$$\begin{aligned} \sin. n a &= 2^{n-1} \cdot \sin. a \cdot \sin. \left(\frac{\pi}{n} - a \right) \cdot \sin. \left(\frac{\pi}{n} + a \right) \cdot \sin. \left(\frac{2\pi}{n} - a \right) \cdot \sin. \left(\frac{2\pi}{n} + a \right) \cdot \sin. \left(\frac{3\pi}{n} - a \right) \\ &\quad \cdot \sin. \left(\frac{3\pi}{n} + a \right) \&c. \\ \text{cof. } n a &= 2^{n-1} \text{cof.} \left(\frac{n-1}{2n} \pi + a \right) \cdot \text{cof.} \left(\frac{n-1}{2n} \pi - a \right) \cdot \text{cof.} \left(\frac{n-3}{2n} \pi + a \right) \cdot \text{cof.} \left(\frac{n-3}{2n} \pi - a \right) \\ &\quad \cdot \text{cof.} \left(\frac{n-5}{2n} \pi + a \right) \cdot \text{cof.} \left(\frac{n-5}{2n} \pi - a \right) \&c. \\ \tan. n a &= \tan. a \cdot \tan. \left(\frac{\pi}{n} - a \right) \tan. \left(\frac{\pi}{n} + a \right) \tan. \left(\frac{2\pi}{n} - a \right) \tan. \left(\frac{2\pi}{n} + a \right) \tan. \left(\frac{3\pi}{n} - a \right) \\ &\quad \tan. \left(\frac{3\pi}{n} + a \right) \&c. \dots \tan. \left(\frac{n\pi}{2n} + a \right) \end{aligned}$$

To these we add the following, which are very simple; *viz.*

$$\sin. a + \sin. (a + b) + \sin. (a + 2b) + \sin. (a + 3b) + \&c. \text{ ad infinitum} = \frac{\text{cof.} (a - \frac{1}{2}b)}{2 \sin. \frac{1}{2}b}; \text{ and}$$

$$\sin. a + \sin. (a + b) + \sin. (a + 2b) + \&c. \sin. (a + n b) = \frac{\sin. (a + \frac{1}{2}b) \sin. \frac{1}{2} (n + 1) b}{\sin. \frac{1}{2}b}$$

$$\text{cof. } a + \text{cof.} (a + b) + \text{cof.} (a + 2b) + \text{cof.} (a + 3b) + \&c. \text{ ad infinitum} = - \frac{\sin. (a - \frac{1}{2}b)}{2 \sin. \frac{1}{2}b}$$

$$\text{cof. } a + \text{cof.} (a + b) + \text{cof.} (a + 2b) + \&c. \text{ cof.} (a + n b) = \frac{\text{cof.} (a + \frac{1}{2}n b) \sin. \frac{1}{2} (n + 1) b}{\sin. \frac{1}{2}b}$$

SINES.

Of the Powers of the Sines, Cofines, &c. of single Arcs.

In order to exhibit the powers of the sine, cofine, &c. of the single arcs, in terms of the sines and cofines of the multiple arcs, we may refer to our formulæ (VIII) and (IX), viz.

$$\left. \begin{aligned} 2 \text{ cof. } a &= y + \frac{1}{y} \\ 2 \text{ cof. } na &= y^n + \frac{1}{y^n} \end{aligned} \right\} \begin{aligned} (-1)^{\frac{1}{2}} \cdot 2 \text{ fin. } a &= y - \frac{1}{y} \\ (-1)^{\frac{1}{2}} \cdot 2 \text{ fin. } na &= y^n - \frac{1}{y^n} \end{aligned}$$

From the first of these we have $2^n \cdot \text{cof.}^n a = \left(y + \frac{1}{y}\right)^n = y^n + A y^{n-2} + B y^{n-4} + C y^{n-6} + \&c. \pm \frac{1}{y^{n-2}} + \frac{1}{y^n}$
 A, B, C, &c. representing the binomial coefficients; or, collecting the terms from each extreme,

$$2^n \text{ cof.}^n a = \left(y^n + \frac{1}{y^n}\right) + A \left(y^{n-2} + \frac{1}{y^{n-2}}\right) + B \left(y^{n-4} + \frac{1}{y^{n-4}}\right) + \&c. \text{ or,}$$

$$2^{n-1} \text{ cof.}^n a = \text{cof. } na + n \cdot \text{cof. } (n-2) a + \frac{n \cdot (n-1)}{1 \cdot 2} \text{ cof. } (n-4) a + \&c. \quad (\text{XIV.})$$

It is only necessary to observe here, that when n is even, the number of terms in the original expansion will be odd, and its middle term, into which no power of y enters, will form the last term of the latter series; and having, therefore, no cofine in it, it will be only one-half of the coefficient given in the general term.

Whence the following particular cases.

1. $\text{cof. } a = \text{cof. } a$
 2. $2 \text{ cof.}^2 a = \text{cof. } 2a + 1$
 3. $4 \text{ cof.}^3 a = \text{cof. } 3a + 3 \text{ cof. } a$
 4. $8 \text{ cof.}^4 a = \text{cof. } 4a + 4 \text{ cof. } 2a + 3$
 5. $16 \text{ cof.}^5 a = \text{cof. } 5a + 5 \text{ cof. } 3a + 10 \text{ cof. } a$
- &c. = &c.

For the sines, we have $(-1)^{\frac{n}{2}} \cdot 2^n \cdot \text{fin.}^n a = \left(y - \frac{1}{y}\right)^n = y^n - A y^{n-2} + B y^{n-4} - C y^{n-6} + \&c. \pm \frac{1}{y^n}$, the last sign being + when n is even, but - when n is odd. Collecting the terms from the two extremes, we have first, when n is even,

$$(-1)^{\frac{n}{2}} \cdot 2^n \cdot \text{fin.}^n a = \left(y^n + \frac{1}{y^n}\right) - A \left(y^{n-2} + \frac{1}{y^{n-2}}\right) + B \left(y^{n-4} + \frac{1}{y^{n-4}}\right) - \&c. \text{ or,}$$

$$(-1)^{\frac{n}{2}} \cdot 2^{n-1} \cdot \text{fin.}^n a = \text{cof. } na - n \text{ cof. } (n-2) a + \frac{n(n-1)}{1 \cdot 2} \text{ cof. } (n-4) a - \&c. \quad (\text{XV.})$$

Observing here the same as above in respect to n , an even number; and when n is odd,

$$(-1)^{\frac{n}{2}} \cdot 2^n \text{ fin.}^n a = \left(y^n - \frac{1}{y^n}\right) - A \left(y^{n-2} - \frac{1}{y^{n-2}}\right) + B \left(y^{n-4} - \frac{1}{y^{n-4}}\right) - \&c. \text{ or}$$

$$(-1)^{\frac{n-1}{2}} \cdot 2^{n-1} \cdot \text{fin.}^n a = \text{fin. } na - n \text{ fin. } (n-2) a + \frac{n(n-1)}{1 \cdot 2} \text{ fin. } (n-4) a - \&c. \quad (\text{XVI.})$$

Observing now the change of sign, which takes place in the imaginary coefficient $(-1)^{\frac{n}{2}}$ and $(-1)^{\frac{n-1}{2}}$, according as n is of the form $4m$, $4m+1$, $4m+2$, or $4m+3$, we draw from the above two formulæ the following particular results viz.

1. $1 \text{ fin. } a = + \text{fin. } a$
 2. $2 \text{ fin.}^2 a = - \text{cof. } 2a - 1$
 3. $4 \text{ fin.}^3 a = - \text{fin. } 3a + 3 \text{ fin. } a$
 4. $8 \text{ fin.}^4 a = + \text{cof. } 4a - 4 \text{ cof. } 2a + 3$
 5. $16 \text{ fin.}^5 a = + \text{fin. } 5a - 5 \text{ fin. } 3a + 10 \text{ fin. } a$
- &c. = &c.

We must now come to a conclusion of our investigations relative to the doctrine of sines; had our limits admitted of it, we might have carried them to a much greater extent, but the above will be sufficient for illustrating the principles of

the most important and useful transformations; and the following results, which would occupy too much space to develop, but which at the same time are too important to be passed over unnoticed, the reader will be able to deduce, with facility, from the formulæ drawn from our general expression, (No. I.) and many others equally curious may be seen in Cagnoli's "Traité de Trigonometrie;" vol. i. of Euler's "Analysis Infinitorum;" Bonnycastle's and Keith's Treatises of Trigonometry, &c. &c.

The formulæ to which we have above referred are the following.

Miscellaneous Formula of frequent Application in the Arithmetic of Sines.

1. $\text{fin. } a \cdot \text{cof. } b = \frac{1}{2} \text{ fin. } (a+b) + \frac{1}{2} \text{ fin. } (a-b)$
2. $\text{cof. } a \cdot \text{fin. } b = \frac{1}{2} \text{ fin. } (a+b) - \frac{1}{2} \text{ fin. } (a-b)$
3. $\text{fin. } a \cdot \text{fin. } b = \frac{1}{2} \text{ cof. } (a \cap b) - \frac{1}{2} \text{ cof. } (a + b)$

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4. $\text{cof. } a \cdot \text{cof. } b = \frac{1}{2} \text{cof. } (a + b) + \frac{1}{2} \text{cof. } (a \text{ } \text{ } b)$
5. $\text{fin. } a + \text{fin. } b = 2 \text{fin. } \frac{1}{2} (a + b) \cdot \text{cof. } \frac{1}{2} (a \text{ } \text{ } b)$
6. $\text{cof. } a + \text{cof. } b = 2 \text{cof. } \frac{1}{2} (a + b) \cdot \text{cof. } \frac{1}{2} (a \text{ } \text{ } b)$
7. $\tan. a + \tan. b = \frac{\text{fin. } (a + b)}{\text{cof. } a \cdot \text{cof. } b}$
8. $\cot. a + \cot. b = \frac{\text{fin. } (a + b)}{\text{fin. } a \cdot \text{fin. } b}$
9. $\text{fin. } a - \text{fin. } b = 2 \text{fin. } \frac{1}{2} (a - b) \cdot \text{cof. } \frac{1}{2} (a + b)$
10. $\text{cof. } a \text{ } \text{ } \text{cof. } b = 2 \text{fin. } \frac{1}{2} (a - b) \cdot \text{fin. } \frac{1}{2} (a + b)$
11. $\tan. a - \tan. b = \frac{\text{fin. } (a - b)}{\text{cof. } a \cdot \text{cof. } b}$
12. $\cot. a \text{ } \text{ } \cot. b = \frac{\text{fin. } (a - b)}{\text{fin. } a \cdot \text{fin. } b}$
13. $\frac{\text{fin. } (a + b)}{\text{fin. } (a - b)} = \frac{\tan. a + \tan. b}{\tan. a - \tan. b} = \frac{\cot. a + \cot. b}{\cot. a - \cot. b}$
14. $\frac{\text{cof. } (a + b)}{\text{cof. } (a \text{ } \text{ } b)} = \frac{\cot. b - \tan. a}{\cot. b + \tan. a} = \frac{\cot. a - \tan. b}{\cot. a + \tan. b}$
15. $\frac{\text{fin. } a + \text{fin. } b}{\text{fin. } a - \text{fin. } b} = \frac{\tan. \frac{1}{2} (a + b)}{\tan. \frac{1}{2} (a - b)}$
16. $\frac{\text{cof. } a + \text{cof. } b}{\text{cof. } a \text{ } \text{ } \text{cof. } b} = \frac{\cot. \frac{1}{2} (a + b)}{\tan. \frac{1}{2} (a - b)}$
17. $\text{fin. } (a - b) \text{fin. } (a + b) = \begin{cases} \text{fin.}^2 a - \text{fin.}^2 b, \text{ or} \\ \text{cof.}^2 a \text{ } \text{ } \text{cof.}^2 b \end{cases}$
18. $\text{cof. } (a \text{ } \text{ } b) \text{cof. } (a + b) = \text{cof.}^2 a - \text{fin.}^2 b$
19. $\frac{\text{fin. } (a - b) \text{fin. } (a + b)}{\text{cof.}^2 a \cdot \text{cof.}^2 b} = \tan.^2 a - \tan.^2 b$
20. $\frac{\text{fin. } (a - b) \text{fin. } (a + b)}{\text{fin.}^2 a \cdot \text{fin.}^2 b} = \cot.^2 a - \cot.^2 b$

If $a + b + c = 180^\circ$, then

21. $\tan. a \cdot \tan. b \cdot \tan. c = \tan. a + \tan. b + \tan. c$
22. $\text{fin. } a \cdot \text{fin. } b \cdot \text{fin. } c = \frac{1}{4} (\text{fin. } 2a + \text{fin. } 2b + \text{fin. } 2c)$

It only remains now to exhibit the method of expressing the sine, cosine, &c. of an arc, in terms of the arc itself; and reverſedly, to expreſs the arc in terms of its ſine, coſine, &c. This is performed with great facility, if we allow ourſelves to employ the principles of the doctrine of fluxions; but our object, in this place, is to perform the ſame by means of the *arithmetic of ſines* only.

For this purpoſe, let x repreſent any arc, then it is obvious that its ſine will be ſome function of this arc, and ſuch a function that it will change its ſign, without changing its magnitude, when the arc, without changing its magnitude changes its ſign, becauſe $\text{fin. } -x = -\text{fin. } x$; conſequently the development of the ſine in functions of the arc, will contain only the odd powers of that arc; if, therefore, we repreſent the coefficients of the odd powers of x by $A, B, C, \&c.$ we ſhall have, or may aſſume,

$$\text{fin. } x = Ax + Bx^3 + Cx^5 + Dx^7, \&c. \quad (\alpha)$$

And if z is another arc,

$$\text{fin. } z = Az + Bz^3 + Cz^5 + Dz^7 + \&c.$$

by ſubtraction,

$$\text{fin. } x - \text{fin. } z = A(x - z) + B(x^3 - z^3) + C(x^5 - z^5) + \&c.$$

but $\text{fin. } x - \text{fin. } z = 2 \text{fin. } \frac{1}{2} (x - z) \cdot \text{cof. } \frac{1}{2} (x + z),$

therefore
$$\frac{2 \text{fin. } \frac{1}{2} (x - z) \cdot \text{cof. } \frac{1}{2} (x + z)}{x - z} = \frac{A(x - z) + B(x^3 - z^3) + C(x^5 - z^5) + \&c.}{x - z}$$

Subſtituting now for $2 \text{fin. } \frac{1}{2} (x - z)$, its expanded value, by changing x , in the firſt ſeries, into $\frac{1}{2} (x - z)$, *viz.* $2 \text{fin. } \frac{1}{2} (x - z) = A(x - z) + \frac{1}{4} B(x - z)^3 + \frac{1}{16} C(x - z)^5 + \&c.$ and dividing both ſides by $(x - z)$, we have, by making, after the diviſion, $x = z,$

$$A \text{cof. } x = A + 3Bx^2 + 5Cx^4 + 7Dx^6 + \&c. \quad (\beta)$$

and conſequently,

$$A \text{cof. } z = A + 3Bz^2 + 5Cz^4 + 7Dz^6 + \&c.$$

Whence, by ſubtraction, and obſerving that

$$\text{cof. } x - \text{cof. } z = -2 \text{fin. } \frac{1}{2} (x + z) \text{fin. } \frac{1}{2} (x - z)$$

$$= -\text{fin. } \frac{1}{2} (x + z) \left\{ A(x - z) + B(x - z)^3 + C(x - z)^5 + \&c. \right\}$$

we ſhall have, after dividing both members by $x - z$, and then making $x = z,$

$$-A^2 \text{fin. } x = 2 \cdot 3 Bx + 4 \cdot 5 Cx^3 + 6 \cdot 7 Dx^5 + \&c.$$

But $\text{fin. } x = Ax + Bx^3 + Cx^5 + \&c.$

therefore

$$-A^2 \text{fin. } x = -A^3 x - A^2 Bx^3 - A^2 Cx^5 + \&c.$$

Whence, by equating the coefficients of the homologous terms, we have

$$2 \cdot 3 B = -A^3; \quad 4 \cdot 5 C = -A^2 B; \\ 6 \cdot 7 D = -A^2 C, \&c.$$

$$B = \frac{-A^3}{2 \cdot 3}; \quad C = \frac{A^5}{2 \cdot 3 \cdot 4 \cdot 5}; \quad D = -\frac{A^7}{2 \cdot 3 \cdot \dots \cdot 7}; \quad \&c.$$

ſo that

$$\text{fin. } x = Ax - \frac{A^3 x^3}{2 \cdot 3} + \frac{A^5 x^5}{2 \cdot 3 \cdot 4 \cdot 5} - \frac{A^7 x^7}{2 \cdot 3 \cdot \dots \cdot 7} + \&c.$$

and it remains only to find the value of A ; which is readily drawn from the following conſideration; *viz.* if we divide both ſides of this equation by x , it becomes

$$\frac{\text{fin. } x}{x} = A - \frac{A^3 x^2}{2 \cdot 3} + \&c.$$

which ought to answer to every value of x ; but when x is indefinitely ſmall, $\text{fin. } x = x$, and therefore the firſt number of the equation = 1; and therefore the ſecond alſo equal 1, conſequently $A = 1$; and we have therefore

$$\text{fin. } x = x - \frac{x^3}{2 \cdot 3} + \frac{x^5}{2 \cdot 3 \cdot 4 \cdot 5} - \frac{x^7}{2 \cdot 3 \cdot \dots \cdot 7} + \&c. \quad (\text{XVII.})$$

and by ſubſtituting, in equation (β) , the above values of $A, B, C, \&c.$ we obtain

$$\text{cof. } x = 1 - \frac{x^2}{2} + \frac{x^4}{2 \cdot 3 \cdot 4} - \frac{x^6}{2 \cdot 3 \cdot \dots \cdot 6} + \&c. \quad (\text{XVIII.})$$

In order to expreſs the arc in terms of the ſine and coſine, let x and z be two arcs; let y be the ſine of the former, and u the ſine of the latter; and ſince, for the ſame reaſon as above, the expanded functions can contain only odd powers of y and u , we will ſuppoſe that

$$x = Ay + By^3 + Cy^5 + Dy^7 + \&c. \quad (\gamma)$$

$$z = Au + Bu^3 + Cu^5 + Du^7 + \&c.$$

and,

and, by subtraction, we have

$$x - z = A(y - u) + B(y^3 - u^3) + C(y^5 - u^5) + \&c.$$

Dividing here both sides by $y - u$, and after the division making $u = y$, it will become

$$\frac{x - z}{y - u} = A + 3By^2 + 5Cy^4 + 7Dy^6 + \&c. \quad (\delta)$$

In order to establish an identity, we must ascertain what the first member becomes, on the supposition of $u = y$, after dividing by $y - u$. Now

$$\frac{x - z}{y - u} = \frac{x - z}{\sin. x - \sin. z} = \frac{x - z}{2 \sin. \frac{1}{2}(x - z) \cos. \frac{1}{2}(x + z)}.$$

Substituting, in the latter denominator, for $2 \sin. \frac{1}{2}(x - z)$, its value, as exhibited in No. (XVII.), and dividing both its members by $x - z$; that fraction becomes

$$\left\{ 1 - \frac{1}{2 \cdot 3 \cdot 4} (x - z)^2 + \&c. \right\} \cos. \frac{1}{2}(x + z);$$

and if now we make $x = z$, we shall find the result will be

$$= \frac{1}{\cos. x}. \quad \text{Now}$$

$$\frac{1}{\cos. x} = \frac{1}{\sqrt{(1 - \sin.^2 x)}} = \frac{1}{\sqrt{(1 - y^2)}} = (1 - y^2)^{-\frac{1}{2}} \\ = 1 + \frac{y^2}{2} + \frac{1 \cdot 3}{2 \cdot 4} y^4 + \frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6} y^6 + \frac{1 \cdot 3 \cdot 5 \cdot 7}{2 \cdot 4 \cdot 6 \cdot 8} y^8 + \&c.$$

and consequently this series is identical with equation (δ), viz. with

$$A + 3By^2 + 5Cy^4 + 7Dy^6 + 9Ey^8 + \&c.$$

Comparing the homologous terms, we have

$$A = 1; B = \frac{1}{2 \cdot 3}; C = \frac{1 \cdot 3}{2 \cdot 4 \cdot 5}; D = \frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6 \cdot 7}; \&c.$$

carrying, therefore, these values into the equation (γ), and substituting $\sin. x$ for y , we have

$$x = \sin. x + \frac{\sin.^3 x}{2 \cdot 3} + \frac{1 \cdot 3 \sin.^5 x}{2 \cdot 4 \cdot 5} + \frac{1 \cdot 3 \cdot 5 \sin.^7 x}{2 \cdot 4 \cdot 6 \cdot 7} + \&c. \quad (\text{XIX.})$$

and since the $\sin. x = \cos. \left(\frac{\pi}{2} - x\right)$, we have, by substituting this expression for $\sin. x$, in the above series,

$$x = \frac{\pi}{2} - \cos. x - \frac{\cos.^3 x}{2 \cdot 3} - \frac{1 \cdot 3 \cos.^5 x}{2 \cdot 4 \cdot 5} - \frac{1 \cdot 3 \cdot 5 \cos.^7 x}{2 \cdot 4 \cdot 6 \cdot 7}$$

- &c. (XX.) in which the arc is expressed in terms of its cosine.

In order to investigate a formula, which shall express the arc in terms of its tangent, it may be shewn, as before,

$$1. a = \sin. a + \frac{\sin.^2 a}{2 \cdot 3} A + \frac{3^2 \sin.^4 a}{4 \cdot 5} B + \frac{5^2 \sin.^6 a}{6 \cdot 7} C + \frac{7^2 \sin.^8 a}{8 \cdot 9} D + \&c.$$

where A, B, C, &c. are the preceding terms.

$$2. \sin. a = a - \frac{a^2}{2 \cdot 3} A + \frac{a^4}{4 \cdot 5} B - \frac{a^6}{6 \cdot 7} C + \frac{a^8}{8 \cdot 9} D - \&c.$$

$$3. a = 90^\circ - \cos. a - \frac{\cos.^3 a}{2 \cdot 3} - \frac{3 \cos.^5 a}{2 \cdot 4 \cdot 5} - \frac{3 \cdot 5 \cos.^7 a}{2 \cdot 4 \cdot 6 \cdot 7} - \&c.$$

$$4. \cos. a = 1 - \frac{a^2}{2} A - \frac{a^4}{3 \cdot 4} B - \frac{a^6}{5 \cdot 6} C - \frac{a^8}{7 \cdot 8} D - \&c.$$

for the sines, that only the odd powers of the tangent can enter into the expressions; assuming, therefore, x and z as two arcs, whose tangents are t and t' , we may assume

$$x = At + Bt^3 + Ct^5 + \&c. \quad (\epsilon)$$

$$z = At' + Bt'^3 + Ct'^5 + \&c.$$

and, by subtraction, we shall have

$$x - z = A(t - t') + B(t^3 - t'^3) + C(t^5 - t'^5) + \&c.$$

Dividing both members by $t - t'$, and afterwards making $t = t'$, we have

$$\frac{x - z}{t - t'} = A + 3Bt^2 + 5Ct^4 + 7Dt^6 + \&c. \quad (\theta)$$

Also, to establish an identity, we have

$$\frac{x - z}{t - t'} = \frac{x - z}{\tan. x - \tan. z} = \frac{(x - z) \sin. (x - z)}{\cos. x \cdot \cos. z} \\ = \frac{(x - z) \cos. x \cdot \cos. z}{\sin. (x - z)}.$$

$$\text{But } \sin. (x - z) = (x - z) - \frac{1}{2 \cdot 3} (x - z)^3 \\ + \frac{1}{2 \cdot 3 \cdot 4 \cdot 5} (x - z)^5 - \&c.$$

If, therefore, we substitute this value for $\sin. (x - z)$, in the denominator of the latter fraction, it becomes, after dividing both members by $(x - z)$,

$$\frac{x - z}{t - t'} = \frac{\cos. x \cdot \cos. z}{1 - \frac{x - z}{2 \cdot 3} + \frac{(x - z)^4}{2 \cdot 3 \cdot 4 \cdot 5} - \&c.}$$

which, on the supposition we have made of $t = t'$; and, consequently, $x = z$, reduces to

$$\cos.^2 x = \frac{1}{\sec.^2 x} = \frac{1}{1 + \tan.^2 x} = \frac{1}{1 + t^2} = \\ 1 - t^2 + t^4 - t^6 + t^8 - \&c.$$

which is therefore identical with our equation (θ), viz.

$$A + 3Bt^2 + 5Ct^4 + 7Dt^6 + \&c.$$

whence, by comparing the coefficients of the like powers of t , we have

$$A = 1, B = -\frac{1}{2}, C = \frac{1}{3}, D = -\frac{1}{4}, \&c.$$

which values substituted in equation (ϵ), gives

$$x = \tan. x - \frac{1}{2} \tan.^3 x + \frac{1}{3} \tan.^5 x - \frac{1}{4} \tan.^7 x + \&c. \quad (\text{XXI.})$$

We shall now conclude this article by exhibiting, in a connected order, a few of the most important developments of angular functions; observing that A, B, C, &c. are the preceding terms.

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$$5. a = \tan. a - \frac{\tan.^3 a}{3} + \frac{\tan.^5 a}{5} - \frac{\tan.^7 a}{7} + \&c.$$

$$6. \tan. a = a + \frac{a^3}{3} + \frac{2a^5}{15} + \frac{17a^7}{315} + \frac{62a^9}{2835} + \&c.$$

$$7. a = \frac{1}{\cot. a} - \frac{1}{3 \cot.^3 a} + \frac{1}{5 \cot.^5 a} - \frac{1}{7 \cot.^7 a} + \&c.$$

$$8. \cot. a = \frac{1}{a} - \frac{a}{3} - \frac{a^3}{45} - \frac{2a^5}{945} - \frac{a^7}{4725} - \&c.$$

$$9. a = 90^\circ - \frac{1}{\sec. a} - \frac{1}{2 \cdot 3 \sec.^3 a} - \frac{3}{2 \cdot 4 \cdot 5 \sec.^5 a} - \&c.$$

$$10. \sec. a = \left\{ \frac{\sec. a - 1}{\sec. a} + \frac{\sec.^3 a - 1}{2 \cdot 3 \sec.^3 a} + \frac{3(\sec.^5 a - 1)}{2 \cdot 4 \cdot 5 \sec.^5 a} + \frac{3 \cdot 5(\sec.^7 a - 1)}{2 \cdot 4 \cdot 6 \cdot 7 \sec.^7 a} + \&c. \right\}$$

$$11. a = \frac{1}{\operatorname{cosec}. a} + \frac{1}{2 \cdot 3 \operatorname{cosec}.^3 a} + \frac{1 \cdot 3}{2 \cdot 4 \cdot 5 \operatorname{cosec}.^5 a} + \frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6 \cdot 7 \operatorname{cosec}.^7 a} + \&c.$$

$$12. \operatorname{cosec}. a = \frac{1}{a} + \frac{a}{6} + \frac{7a^3}{360} + \frac{31a^5}{15120} + \frac{127a^7}{604800} + \&c.$$

$$13. a = 2 \sqrt{2 \operatorname{verf}. a} \left\{ 1 + \frac{\operatorname{verf}. a}{2^2 \cdot 3} + \frac{1 \cdot 3 \operatorname{verf}. a}{2^3 \cdot 4 \cdot 5} + \frac{1 \cdot 3 \cdot 5 \operatorname{verf}. a}{2^4 \cdot 4 \cdot 6 \cdot 7} + \&c. \right\}$$

$$14. \log. \sin. a = \log. a - \frac{1}{M} \left\{ \frac{a^2}{2 \cdot 3} + \frac{a^4}{2^2 \cdot 3 \cdot 5} + \frac{a^6}{3^2 \cdot 5 \cdot 7} + \&c. \right\}$$

$$15. \log. \operatorname{cosec}. a = \log. 1 - \frac{1}{M} \left\{ \frac{a^2}{2} + \frac{a^4}{3 \cdot 4} + \frac{a^6}{3^2 \cdot 5} + \&c. \right\}$$

$$16. \log. \tan. a = \log. a + \frac{1}{M} \left\{ \frac{a^2}{3} + \frac{7a^4}{2 \cdot 3^2 \cdot 5} + \frac{62a^6}{3^4 \cdot 5 \cdot 7} + \&c. \right\}$$

In all these series, as also throughout the entire article, we have supposed radius = 1; if in any case the radius r be required, it may be introduced by giving it such a power as will render the quantities on both sides of the equation of the same dimension with regard to the powers of its factors.

SINES, Cosines, &c. Figures of, are figures made by conceiving the circumference of a circle extended out in a right line, upon every point of which are erected perpendicular ordinates, equal to the sines, cosines, &c. of the corresponding arcs, and drawing a curve line through the extremities of all the ordinates, which is then the figure of the sines, cosines, &c.

It appears that these figures took their rise from the circumstance of the extension of the meridian line by Edward Wright, who computed that line by collecting the successive sums of the secants, which is the same thing as the area of the figures of the secants. This being made up of all the ordinates or secants by the construction of the figure, and in imitation of this, the figures of the other lines have been invented. By means of the figures of the secants, James Gregory shewed how the logarithmic tangents may be constructed in his "Exercitationes Geometricæ," 4to. 1668.

Construction of the Figures of the Sines, Cosines, &c.—Let $A D B$, &c. (Plate I. fig. 10.) be the circle, $A D$ an arc, $D E$ its sine, $C E$ its cosine, $A E$ the versed sine, $A F$ the tangent, $G H$ the cotangent, $C F$ the secant, and $C H$ the cosecant.

Draw a line aa (fig. 11.), equal to the whole circumference $A D G B A$ of the circle, upon which lay off also the length of several arcs, as of every ten degrees, from o at a ,

to 360° at the other end at a ; upon these points raise perpendicular ordinates upwards or downwards, according as the sine, cosine, &c. is affirmative or negative in that part of the circle; lastly, upon these set off the length of the sines, cosines, &c. corresponding to the arcs at those points, or circumference aa , drawing a curve line through the extremities of all these ordinates, which will be the figure of the sines, cosines, versed sines, tangents, cotangents, secants, and cosecants, as in figs. 11, 12, 13, 14, 15, 16, 17, where it may be observed, that the following curves are the same, namely, those of the sines and cosines, tangents and cotangents, and those of the secants and cosecants, only some of their parts a little differently placed.

It may be known when any of these lines, *viz.* the sines, cosines, &c. are positive or negative; that is, to be set upwards or downwards; by observing the following general rules for those lines, in the 1st, 2d, 3d, and 4th quadrants of the circle.

The sines	{	in the 1st and 2d	are affirmative,
		in the 2d and 4th	negative.
The cosines	{	in the 1st and 4th	affirmative,
		in the 2d and 3d	negative.
The tangents	{	in the 1st and 3d	affirmative,
		in the 2d and 4th	negative.
The cotangents	{	in the 1st and 3d	affirmative,
		in the 2d and 4th	negative.
The secants	{	in the 1st and 4th	affirmative,
		in the 2d and 3d	negative.

and all the versed sines are affirmative.

To find the Equation and Area of each of those Curves.—Draw an ordinate, *dc*, putting r = the radius $A C$ of the given

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given circle, $x = ad$, or AD any absciss or arc, and $y = de$, its ordinate, which will be either the sine DE = s , cosine CE = c , versed sine AE = v , tangent AF = t , cotangent GH = τ , secant CF = f , or cosecant CH = σ , according to the nature of the particular construction. Now, from the nature of the circle are obtained these following general equations, expressing the relations between the fluxions and the circular arc, and its sine, cosine, &c.

$$\dot{x} = \frac{r\dot{s}}{\sqrt{(r^2 - s^2)}} = \frac{-r\dot{c}}{\sqrt{(r^2 - c^2)}} = \frac{r\dot{v}}{\sqrt{(2rv - v^2)}}$$

$$= \frac{r^2\dot{t}}{r^2 + t^2} = \frac{-r^2\dot{\tau}}{r^2 + \tau^2} = \frac{r^2\dot{f}}{f\sqrt{(f^2 - r^2)}} = \frac{-r^2\dot{\sigma}}{\sigma\sqrt{(\sigma^2 - r^2)}}$$

and these also express the relation between the absciss and ordinates of the curves in question, each in the order in which it stands; where x is the common absciss to all of them, and the respective ordinates are s, c, v, t, τ, f , and σ ; and hence the area of any of these curves may be found as follows.

1. In the Figure of the Sines, (fig. 11.) Here $x = ad$, and $s =$ the ordinate de , and the equation of the curve, as

above, is $\dot{x} = \frac{r\dot{s}}{\sqrt{(r^2 - s^2)}}$. Hence the fluxion of the

area, or $s\dot{x} = \frac{rs\dot{s}}{\sqrt{(r^2 - s^2)}}$, the correct fluent of which is

$r^2 \mp r\sqrt{(r^2 - s^2)} = r^2 - rc = rv =$ the rectangle of radius and versed sine minus or plus, according as s is increasing or decreasing; which is a general expression for the area ade in the figure of sines. When $s = 0$, as at a , or b , this expression becomes 0, or $2r^2$; that is, 0 at a , and $2r^2$ at b ; that is, the whole area $acb = 2r^2$.

2. In the Figure of the Cosines, (fig. 12.) Here $x = ad$, and

$c = de$; and the equation of the curve is $\dot{x} = \frac{-r\dot{c}}{\sqrt{(r^2 - c^2)}}$;

hence the fluxion of the area = $c\dot{x} = \frac{-rc\dot{c}}{\sqrt{(r^2 - c^2)}}$; and

the correct fluent of this = $r\sqrt{(r^2 - c^2)} = sr$, the rectangle of the radius and sine for the general area adc . When $s = r$, or $c = 0$, this becomes $r^2 =$ area afc , whose absciss af is equal to a quadrant of the circumference; the same as the figure of the sines upon an equal absciss.

3. In the Figure of the versed Sines, (fig. 13.) Here $x = ad$, and $v = de$, and the equation of the curve is $\dot{x} =$

$\frac{r\dot{v}}{\sqrt{(2rv - v^2)}}$; hence the fluxion of the area is $v\dot{x} =$

$\frac{rv\dot{v}}{\sqrt{(2rv - v^2)}} = \frac{r\dot{v}\sqrt{v}}{\sqrt{(2r - v)}}$; and the fluent of this

is $rx - rs = r(x - s) =$ the general area in the figure of the versed sines. When ad is a quadrant, this becomes

$\frac{3.1416}{2} r^2 - r^2 =$ the area afg ; and when ad is a semi-

circle it becomes $3.1416 r^2$, the whole area of the figure of versed sines.

4. In the Figure of the Tangents, (fig. 14.) Here $x = ad$, and $t = de$; and the equation of the curve becomes $\dot{x} =$

$\frac{r^2\dot{t}}{r^2 + t^2}$; and hence the fluxion of the area is $t\dot{x} =$

$\frac{r^2 t \dot{t}}{r^2 + t^2}$; the correct fluent of which is $\frac{1}{2} r^2 \cdot \text{hyp. log.}$

$\frac{r^2 + t^2}{r^2} = r^2 \cdot \text{hyp. log.} \frac{\sqrt{(r^2 + t^2)}}{r} = r^2 \cdot \text{hyp. log.}$

$\frac{f}{r}$; and hence the figure of the tangents may be used for

the construction of the logarithmic secants; a property first pointed out by Gregory at the end of his "Exercit. Geometricæ."

When ad becomes the quadrant af , t being then infinite, this becomes infinite for the area afg ; and the same for the figure of cotangents, beginning at f , instead of a . See fig. 15.

5. Figure of the Secants, (fig. 16.) Here $x = ad$, and $f = de$; and the equation of the curves is $\dot{x} =$

$\frac{r^2\dot{f}}{f\sqrt{(f^2 - r^2)}}$, and the fluxion of the area is $f\dot{x} =$

$\frac{r^2\dot{f}f}{f\sqrt{(f^2 - r^2)}}$, the fluent of which is $r^2 \cdot \text{hyp. log.}$

$\frac{f + \sqrt{(f^2 - r^2)}}{r}$ for the general area ade ; which is

infinite when ad becomes equal to a quadrant. The same process answers for the cosecants, beginning at f instead of a . See fig. 17.

Hence the meridional parts in Mercator's chart may be calculated for any latitude AD or ad . For the meridional parts: arc of latitude :: the sum of the secants: the sum of as many radii, or :: area ade : $ad \times \text{rad. } ac$; or AD \times AC in fig. 10.

SINES, *Line of*, a line on the sector, Gunter's scale, &c. the description and use of which see under the articles SECTOR, and GUNTER'S Scale.

In estimating the quantity of sines, &c. we assume radius for unity; and determine the quantity of the sines, tangents, and secants, in fractions thereof. From Ptolemy's Almagest we learn, that the ancients divided the radius into 60 parts; which they called degrees, and thence determined the chords in minutes, seconds, and thirds; that is, in sexagesimal fractions of the radius, which they likewise used in the resolution of triangles.

The sines, or half chords, for aught that appears, were first used by the Saracens.

Regiomontanus, at first, with the ancients, divided the radius into sixty degrees, and determined the sines of the several degrees in decimal fractions of it. But he afterwards found it would be more commodious to assume radius for 1; and thus introduced the present method into trigonometry.

In the common tables of sines and tangents, the radius is conceived divided into 1000000 parts, beyond which we never go, in determining the quantity of the sines and tangents. Hence, as the side of an hexagon subtends the sixth part of a circle, and is equal to radius, the sine of 30° is half the radius, or 500000.

1. The sine AD being given (fig. 4.), to find the sine-complement. From the square of the radius AC subtract the square of the sine AD; the remainder will be the square of the sine-complement DC or AG: whence the square root being extracted, we have the sine-complement. E. gr. Supposing AC 1000000, and AD 500000, AG will be found 8660254, the sine of 60° .

2. The sine AD of the arc AE being given (fig. 18.), to find the

the sine of the half arc, or half of AB. Find the chord of the arc AB; for half of this is its sine. Thus supposing AG and AD, as in the preceding problem: we shall find the sine of half the arc AB, or the sine of 15°, = 2588190.

3. The sine DG of the arc DF being given, to find the sine DE of the double arc DB (fig. 19.) Since the angles at E and G are right angles, and the angle B is common to each triangle BCG and DEB, we shall have BC : CG :: BD : DE; wherefore CG being found by the first problem, and BD being double of DG, DE is found by the rule of proportion.

4. The sines FG and DE (fig. 20.) of the arcs FA and DA, whose difference DF is not greater than 45 minutes, being given, to find any intermediate sine, as IL. To the difference FD of the arcs, whose sines are given, the difference of the arc AI, whose sine is required, and AF, viz. IF, and the difference of the given sines DH, find a fourth proportional: this, added to the less given sine FG, the aggregate will be the sine required.

5. To find the sine of 45 degrees. Let HI (fig. 4.) be a quadrant of a circle; then will HCI be a right angle; consequently the triangle rectangular; therefore $HI^2 = HC^2 + CI^2 = 2 HC^2$; wherefore, since HC the whole sine is 10000000; if from $2 HC^2$, 200000000000000, be extracted the square root 14142136; we shall have the chord HI, whose half 7071068, is the sine of 45° required.

6. The side of a pentagon being given (see POLYGON), the sine of 36° may be easily found. For the sine of 36° is equal to half 11755706, i. e. = 5877853.

7. The sine of a minute, or 60", FG (fig. 20.) being given, to find the sine of one or more seconds MN. Since the arcs AM and AF are very small, AMF may be taken for a right line, without any sensible error in the decimal fractions of the radius, in which the sine is expressed; that is, the arcs AM and AF may be taken proportional to their chords. Wherefore, since MN is parallel to FG, we shall have AF : FG :: AM : MN; therefore, AF, FG, and AM, being given, MN is easily had.

SINES, to construct a canon of. The sines of 30°, 15°, 45°, and 36° (which we have already shewn how to find) being had; we can thence construct a canon of all the sines to every minute, or every second. For from the sine of 36° we find those of 18° 9' 4" 30", and 2° 15', by the second problem: the sines of 54° 72' 81° 85' 30", and 87° 45', &c. by the first problem.

Again, from the sine of 45°, find the sine of 22° 30' 11" 15', &c. From the sine of 30°, and the sine of 54°, find the sine of 12°. From the sine of 12°, find the sines of 6° 3' 1" 30' 45' 78" 84", &c. From the sine of 15°, find the sine of 7° 30' 3" 45', &c. till you have 120 sines succeeding each other orderly, at an interval of 44 minutes. Between these, find the intermediate sines by the fourth problem: thus will the canon be complete.

From the sine of an arc given, to find the tangent and secant. See TANGENT, SECANT, and sequel of this article.

To find the logarithm of a given sine, called the artificial sine, see LOGARITHM. Wolfii Element. Math. vol. i. p. 214, &c.

There are various other methods of constructing the triangular or trigonometrical canon. We shall here subjoin the following, as the most simple and easy. But it will be necessary to premise the three subsequent propositions.

1. The sine EF of an arc AE (fig. 21.) being given, to find its cosine CF, versed sine AF, tangent AT, cotangent

DH, secant CT, and cosecant CH. The cosine CF is evidently = $\sqrt{CE^2 - EF^2}$, and the versed sine = CE or CA - CF. And the triangles CFE, CAT, and CDH being similar, we shall have CF : FE :: CA : AT; or the tangent will be a fourth proportional to the cosine, the sine, and radius; and CF : CE (CA) :: CA : CT, whence the secant is a third proportional to the cosine and radius; and EF : CF :: CD : DH, or the cotangent is a fourth proportional to the sine, cosine, and radius; and EF : EC (CD) :: CD : DH, or the cosecant, is a third proportional to the sine and radius. Moreover, because AT : AC :: CD (AC) : DH, the rectangle of the tangent and cotangent is equal to the square of the radius, and, therefore, the tangent of half a right angle, being equal to its cotangent, is equal to the radius; and the cotangents of any two different arcs (represented by P and Q), are to one another inversely as their tangents; for tang. P × cotang. P = rad.² = tang. Q × cotang. Q: therefore cotang. P : cotang. Q :: tang. Q : tang. P, or cotang. P : tang. Q :: cotang. Q : tang. P.

2. If there be three equidifferent arcs AB, AC, AD, (fig. 22.) we shall have radius is the cosine of their common difference BC, or CD, as the sine CF of the mean, to half the sum of the sines BE + DG of the two extremes; and as radius to the sine of the common difference, so is the cosine of the mean to half the difference of the sines of the two extremes. For let BD be drawn, intersecting OC in m; also draw mn parallel to CF, and BH and mv parallel to AO. The arcs BC and CD being equal, OC is perpendicular to BD, and bisects it; and, therefore, Bm or Dm will be the sine of BC or DC, and Om its cosine. Moreover mn, being an arithmetical mean between the sines BE, DG, of the two extremes (because Bm = Dm) is, therefore, equal to half their sum, and Dv equal to half their difference. But the triangles OCF, Omn, and Dvm, being similar, we shall have OC : Om :: CF : mn,

$$\text{and } OC : Dm :: FO : Dv. \text{ Whence } mn = \frac{DG + BE}{2}$$

$$= \frac{Om \times CF}{OC}, \text{ and } Dv = \frac{DG - BE}{2} = \frac{Dm \times FO}{OC},$$

$$\text{and consequently } DG + BE = \frac{2Om \times CF}{OC}, \text{ and } DG$$

$$- BE = \frac{2Dm \times FO}{OC}. \text{ And, moreover, if the mean arc}$$

AC be 60°, OF its cosine will be = sine 30° = $\frac{1}{2}$ chord 60° = $\frac{1}{2}$ OC; consequently DG - BE will, in this case, be barely = Dm, and DG = Dm + BE. Hence it follows: 1. That if the sine of the mean of three equidifferent arcs (radius being unity) be multiplied by twice the cosine of the common difference, and the sine of either extreme be subtracted from the product, the remainder will be the sine of the other extreme. And, 2. The sine of any arc above 60° is equal to the sine of another arc, as much below 60°, together with the sine of its excess above 60°.

3. To find the sine of a very small arc, e. gr. of 15'. The chords of very small arcs being to each other nearly as the arcs themselves, we shall have $\frac{1}{15}$ th of the semiperiphery : $\frac{1}{15}$ th :: 360 : 384) :: .00818121, the chord of $\frac{1}{15}$ th : .008726624, the chord of $\frac{1}{10}$ th of the semiperiphery, or half a degree, whose half, or .004363312, is the sine of 15', very nearly; and, therefore, 15' : 1' :: .004363312 : .000290888, the sine of the arc of 1' nearly.

SINES.

Upon the foregoing principles the canon may be easily constructed. For, the sine of 1' being .0002908882, its square is .0000008461594, which subtracted from the square of the radius 1, leaves .9999991538406, whose square root .999999577 is the cosine of 1', or the sine of 89° 59'. Now having the sine and cosine of 1', the other sines may be found in the following manner. Let the cosine of 1' be called C, and we shall have by prop. 2. supra.

$$\begin{aligned}
 2 C \times \text{fine } 1' - \text{fine } 0' &= \text{fine } 2' = .0005817764 \\
 2 C \times \text{fine } 2' - \text{fine } 1' &= \text{fine } 3' = .0008726645 \\
 2 C \times \text{fine } 3' - \text{fine } 2' &= \text{fine } 4' = .0011635526 \\
 2 C \times \text{fine } 4' - \text{fine } 3' &= \text{fine } 5' = .0014544406 \\
 2 C \times \text{fine } 5' - \text{fine } 4' &= \text{fine } 6' = .0017453283, \text{ \&c.}
 \end{aligned}$$

Thus are the sines of 7', 8', 9', &c. successively derived from each other. The sines of every degree and minute, up to 60°, being thus found; those of above 60° will be had by addition only, by prop. 2. supra; and the sines being all known, the tangents and secants will likewise become known by prop. 1. supra. If all these numbers be multiplied by the radius of any table (radius being here supposed unity), we shall have the natural sines, tangents, &c. of such a table. It will be sufficient to compute the sine of every fifth minute only by the preceding method; because the sines of all the intermediate arcs may be had from them, by taking the proportional parts of the differences so near, as to give the first six places true in each number. *E. gr.* $2 C 5' \times \text{fine } 5' - \text{fine } 0' = \text{fine } 10'$; subtract the sine 5' from that of 10'; add $\frac{1}{2}$ th of the remainder to the sine 5', for the sine of 6', to which add the same $\frac{1}{3}$ th for the sine of 7', &c. to 10'. Again, $2 C 5' \times \text{fine } 10' - \text{fine } 5' = \text{fine } 15'$, &c. Simpson's Trigonometry, p. 10, &c. Robertson's Elem. Navig. book iii. § 2.

The tables now chiefly used in trigonometrical computations, exhibit the logarithms of those numbers, which express the lengths of the sines, tangents, &c. which, in order to distinguish them from the natural ones, are called logarithmic or artificial sines, tangents, &c. A table of this kind, the use of which often occurs in the course of this work, is here annexed. The sines, tangents, &c. of

any arc are easily found, by seeking the degree at the top, if the arc be less than 45°, and the minutes at the side, beginning from the top, and by seeking the degree, &c. at the bottom, if the arc be greater than 45°. If a given logarithmic sine, or tangent, falls between those in the tables, the corresponding degrees and minutes may be reckoned $\frac{1}{3}$, $\frac{1}{2}$, or $\frac{2}{3}$, &c. minutes more than those belonging to the nearest less logarithm in the tables, according as its difference from the given one is $\frac{1}{3}$, or $\frac{1}{2}$, or $\frac{2}{3}$, &c. of the difference between the logarithm next greater and next less than the given log. Or generally, as 60'' is to the difference between any two consecutive tabular sines; so is the number of seconds beyond the less tabular sine, to the proportional part that is to be added to it. Thus if it were required to find the sine of 1° 28' 45'':

Sine 1° 29' is	-	-	8.4130676
Sine 1° 28' is	-	-	8.4081614
Difference	-	-	49062

Then as 60'' : 49062 :: 45'' : 36796.

Therefore to	-	-	8.4081614
Add	-	-	36796
Sine 1° 28' 45'' is	-	-	8.4118410

And in the same manner may the tangent or cotangent of any angle be found to seconds. The secants and cosecants are not given in the table, but they are readily found as follows; *viz.* any cosecant is found by subtracting the sine from 20.0000000, and the secant by subtracting the cosine from 20.0000000. See Sherwin's Mathematical Tables, which contain both the natural and artificial sines, &c. and Gardiner's Tables of Logarithms, &c. in which the logarithms of the sines are computed to every second in the first seventy-two minutes of the quadrant. But the most correct English table at present extant is Dr. Hutton's, containing the logarithms of all numbers to 100000, and the natural and logarithmic sines, cosines, tangents, &c. to every minute of the quadrant.

SINES.

TABLE of Logarithmic Sines and Tangents to every Minute of the Quadrant.

Min.	0 Degree.				60
	Sine.	Cofine.	Tang.	Cotangent.	
0	0.0000000	10.0000000	0.0000000	Infinite.	60
1	6.4637261	9.9999999	6.4637261	13.5362739	59
2	6.7647561	9.9999999	6.7647562	13.2352438	58
3	6.9408473	9.9999998	6.9408475	13.0591525	57
4	7.0657860	9.9999997	7.0657863	12.9342137	56
5	7.1626960	9.9999995	7.1626964	12.8373036	55
6	7.2418771	9.9999993	7.2418778	12.7581222	54
7	7.3088239	9.9999991	7.3088248	12.6911752	53
8	7.3668157	9.9999988	7.3668169	12.6331831	52
9	7.4179681	9.9999985	7.4179696	12.5820304	51
10	7.4637255	9.9999982	7.4637273	12.5362727	50
11	7.5051181	9.9999978	7.5051203	12.4948797	49
12	7.5429065	9.9999974	7.5429091	12.4570909	48
13	7.5776684	9.9999969	7.5776715	12.4223285	47
14	7.6098530	9.9999964	7.6098566	12.3901434	46
15	7.6398160	9.9999959	7.6398201	12.3601799	45
16	7.6678445	9.9999953	7.6678492	12.3321508	44
17	7.6941733	9.9999947	7.6941786	12.3058214	43
18	7.7189966	9.9999940	7.7190026	12.2809974	42
19	7.7424775	9.9999934	7.7424841	12.2575159	41
20	7.7647537	9.9999927	7.7647610	12.2352390	40
21	7.7859247	9.9999919	7.7859508	12.2140492	39
22	7.8061458	9.9999911	7.8061547	12.1938453	38
23	7.8254507	9.9999903	7.8254604	12.1745396	37
24	7.8439338	9.9999894	7.8439444	12.1560556	36
25	7.8616623	9.9999885	7.8616738	12.1383262	35
26	7.8786953	9.9999876	7.8787077	12.1212923	34
27	7.8950854	9.9999866	7.8950988	12.1049012	33
28	7.9108793	9.9999856	7.9108938	12.0891062	32
29	7.9261190	9.9999845	7.9261344	12.0738656	31
30	7.9408419	9.9999835	7.9408584	12.0591416	30
31	7.9550819	9.9999823	7.9550996	12.0449004	29
32	7.9688698	9.9999812	7.9688886	12.0311114	28
33	7.9822334	9.9999800	7.9822534	12.0177466	27
34	7.9951980	9.9999788	7.9952192	12.0047808	26
35	8.0077867	9.9999775	8.0078092	11.9921908	25
36	8.0200207	9.9999762	8.0200445	11.9799555	24
37	8.0319195	9.9999748	8.0319446	11.9680554	23
38	8.0435009	9.9999735	8.0435274	11.9564726	22
39	8.0547814	9.9999721	8.0548094	11.9451906	21
40	8.0657763	9.9999706	8.0658057	11.9341943	20
41	8.0764997	9.9999691	8.0765306	11.9234694	19
42	8.0869646	9.9999676	8.0869970	11.9130030	18
43	8.0971832	9.9999660	8.0972172	11.9027828	17
44	8.1071669	9.9999644	8.1072025	11.8927975	16
45	8.1169262	9.9999628	8.1169634	11.8830366	15
46	8.1264710	9.9999611	8.1265099	11.8734901	14
47	8.1358104	9.9999594	8.1358510	11.8641490	13
48	8.1449532	9.9999577	8.1449956	11.8550044	12
49	8.1539075	9.9999559	8.1539516	11.8460484	11
50	8.1626808	9.9999541	8.1627267	11.8372733	10
51	8.1712804	9.9999522	8.1713282	11.8286718	9
52	8.1797129	9.9999503	8.1797626	11.8202374	8
53	8.1879848	9.9999484	8.1880364	11.8119636	7
54	8.1961020	9.9999464	8.1961556	11.8038444	6
55	8.2040703	9.9999444	8.2041259	11.7958741	5
56	8.2118949	9.9999424	8.2119266	11.7880474	4
57	8.2195811	9.9999403	8.2196408	11.7803592	3
58	8.2271335	9.9999382	8.2271953	11.7728047	2
59	8.2345568	9.9999360	8.2346208	11.7653792	1
60	8.2418553	9.9999338	8.2419215	11.7580785	0
	Cofine.	Sine.	Cotangent.	Tang.	

Min.	1 Degree.				60
	Sine.	Cofine.	Tang.	Cotangent.	
0	8.2418553	9.9999338	8.2419215	11.7580785	60
1	8.2490332	9.9999316	8.2491015	11.7508985	59
2	8.2560943	9.9999294	8.2561649	11.7438351	58
3	8.2630424	9.9999271	8.2631153	11.7368847	57
4	8.2698810	9.9999247	8.2699563	11.7300437	56
5	8.2766136	9.9999224	8.2766912	11.7233088	55
6	8.2832434	9.9999200	8.2833234	11.7166766	54
7	8.2897734	9.9999175	8.2898559	11.7101441	53
8	8.2962067	9.9999150	8.2962917	11.7037083	52
9	8.3025460	9.9999125	8.3026335	11.6973665	51
10	8.3087941	9.9999100	8.3088842	11.6911158	50
11	8.3149536	9.9999074	8.3150462	11.6849538	49
12	8.3210269	9.9999047	8.3211221	11.6788779	48
13	8.3270163	9.9999021	8.3271143	11.6728857	47
14	8.3329243	9.9998994	8.3330249	11.6669751	46
15	8.3387529	9.9998966	8.3388563	11.6611437	45
16	8.3445043	9.9998939	8.3446105	11.6553895	44
17	8.3501805	9.9998911	8.3502895	11.6497105	43
18	8.3557835	9.9998882	8.3558953	11.6441047	42
19	8.3613150	9.9998853	8.3614297	11.6385703	41
20	8.3667769	9.9998824	8.3668945	11.6331055	40
21	8.3721710	9.9998794	8.3722915	11.6277085	39
22	8.3774988	9.9998764	8.3776223	11.6223777	38
23	8.3827620	9.9998734	8.3828886	11.6171114	37
24	8.3879622	9.9998703	8.3880918	11.6119082	36
25	8.3931008	9.9998672	8.3932336	11.6067664	35
26	8.3981793	9.9998641	8.3983152	11.6016848	34
27	8.4031990	9.9998609	8.4033381	11.5966619	33
28	8.4081614	9.9998577	8.4083037	11.5916963	32
29	8.4130676	9.9998544	8.4132132	11.5867868	31
30	8.4179190	9.9998512	8.4180679	11.5819321	30
31	8.4227168	9.9998478	8.4228690	11.5771310	29
32	8.4274621	9.9998445	8.4276176	11.5723824	28
33	8.4321561	9.9998411	8.4323150	11.5676850	27
34	8.4367999	9.9998376	8.4369622	11.5630378	26
35	8.4413944	9.9998342	8.4415603	11.5584397	25
36	8.4459409	9.9998306	8.4461103	11.5538897	24
37	8.4504402	9.9998271	8.4506131	11.5493869	23
38	8.4548934	9.9998235	8.4550699	11.5449301	22
39	8.4593013	9.9998199	8.4594814	11.5405186	21
40	8.4636649	9.9998162	8.4638486	11.5361514	20
41	8.4679850	9.9998125	8.4681725	11.5318275	19
42	8.4722626	9.9998088	8.4724538	11.5275462	18
43	8.4764984	9.9998050	8.4766933	11.5233067	17
44	8.4806932	9.9998012	8.4808920	11.5191080	16
45	8.4848479	9.9997974	8.4850505	11.5149495	15
46	8.4889632	9.9997935	8.4891696	11.5108304	14
47	8.4930398	9.9997896	8.4932502	11.5067498	13
48	8.4970784	9.9997856	8.4972928	11.5027072	12
49	8.5010798	9.9997817	8.5012982	11.4987018	11
50	8.5050447	9.9997776	8.5052671	11.4947329	10
51	8.5089736	9.9997736	8.5092001	11.4907999	9
52	8.5128673	9.9997695	8.5130978	11.4869022	8
53	8.5167264	9.9997653	8.5169610	11.4830390	7
54	8.5205514	9.9997612	8.5207902	11.4792098	6
55	8.5243430	9.9997570	8.5245860	11.4754140	5
56	8.5281017	9.9997527	8.5283490	11.4716510	4
57	8.5318281	9.9997484	8.5320797	11.4679203	3
58	8.5355228	9.9997441	8.5357787	11.4642213	2
59	8.5391863	9.9997398	8.5394466	11.4605534	1
60	8.5428192	9.9997354	8.5430838	11.4569162	0
	Cofine.	Sine.	Cotangent.	Tang.	

SINES.

2 Degrees.				
Min.	Sine.	Cofine.	Tang.	Cotangent.
0	8.5428192	9.9997354	8.5430838	11.4569162
1	8.5464218	9.9997309	8.5466909	11.4533309
2	8.5499948	9.9997265	8.5502683	11.4497317
3	8.5535386	9.9997220	8.5538106	11.4461834
4	8.5570536	9.9997174	8.5573362	11.4426638
5	8.5605404	9.9997128	8.5608276	11.4391724
6	8.5639994	9.9997082	8.5642912	11.4357088
7	8.5674310	9.9997036	8.5677275	11.4322725
8	8.5708357	9.9996990	8.5711368	11.4288632
9	8.5742139	9.9996942	8.5745197	11.4254803
10	8.5775660	9.9996894	8.5778766	11.4221234
11	8.5808923	9.9996846	8.5812077	11.4187923
12	8.5841933	9.9996798	8.5845136	11.4154864
13	8.5874694	9.9996749	8.5877945	11.4122055
14	8.5907209	9.9996700	8.5910509	11.4089491
15	8.5939483	9.9996650	8.5942832	11.4057168
16	8.5971517	9.9996601	8.5974917	11.4025083
17	8.6003317	9.9996550	8.6006767	11.3993233
18	8.6034886	9.9996500	8.6038386	11.3961614
19	8.6066226	9.9996449	8.6069777	11.3930223
20	8.6097341	9.9996398	8.6100943	11.3899057
21	8.6128235	9.9996346	8.6131889	11.3868111
22	8.6158910	9.9996294	8.6162616	11.3837384
23	8.6189369	9.9996242	8.6193127	11.3806873
24	8.6219616	9.9996189	8.6223427	11.3776573
25	8.6249653	9.9996136	8.6253518	11.3746482
26	8.6279484	9.9996082	8.6283402	11.3716598
27	8.6309111	9.9996028	8.6313083	11.3686917
28	8.6338537	9.9995974	8.6342563	11.3657437
29	8.6367764	9.9995919	8.6371845	11.3628155
30	8.6396796	9.9995865	8.6400931	11.3599069
31	8.6425634	9.9995809	8.6429825	11.3570175
32	8.6454282	9.9995753	8.6458528	11.3541472
33	8.6482742	9.9995697	8.6487044	11.3512956
34	8.6511016	9.9995641	8.6515375	11.3484625
35	8.6539107	9.9995584	8.6543522	11.3456478
36	8.6567017	9.9995527	8.6571490	11.3428510
37	8.6594748	9.9995469	8.6599279	11.3400721
38	8.6622303	9.9995411	8.6626891	11.3373109
39	8.6649684	9.9995353	8.6654331	11.3345669
40	8.6676893	9.9995295	8.6681598	11.3318402
41	8.6703932	9.9995236	8.6708697	11.3291303
42	8.6730804	9.9995176	8.6735628	11.3264372
43	8.6757510	9.9995116	8.6762393	11.3237607
44	8.6784052	9.9995056	8.6788996	11.3211004
45	8.6810433	9.9994996	8.6815437	11.3184563
46	8.6836654	9.9994935	8.6841719	11.3158281
47	8.6862718	9.9994874	8.6867844	11.3132156
48	8.6888625	9.9994812	8.6893813	11.3106187
49	8.6914379	9.9994750	8.6919629	11.3080371
50	8.6939980	9.9994688	8.6945292	11.3054708
51	8.6965431	9.9994625	8.6970806	11.3029194
52	8.6990734	9.9994562	8.6996172	11.3003828
53	8.7015889	9.9994498	8.7021390	11.2978610
54	8.7040899	9.9994435	8.7046466	11.2953535
55	8.7065766	9.9994370	8.7071395	11.2928605
56	8.7090490	9.9994306	8.7096185	11.2903815
57	8.7115075	9.9994241	8.7120834	11.2879166
58	8.7139520	9.9994176	8.7145345	11.2854655
59	8.7163829	9.9994110	8.7169719	11.2830281
60	8.7188002	9.9994044	8.7193958	11.2806042
	Cofine.	Sine.	Cotangent.	Tang.

87 Degrees.

Min.

3 Degrees.				
Min.	Sine.	Cofine.	Tang.	Cotangent.
0	8.7188002	9.9994044	8.7193958	11.2806042
1	8.7212040	9.9993978	8.7218063	11.2781937
2	8.7235946	9.9993911	8.7242035	11.2757965
3	8.7259721	9.9993844	8.7265877	11.2734123
4	8.7283366	9.9993776	8.7289589	11.2710411
5	8.7306882	9.9993708	8.7313174	11.2686826
6	8.7330272	9.9993640	8.7336631	11.2663369
7	8.7353535	9.9993572	8.7359964	11.2640036
8	8.7376675	9.9993503	8.7383172	11.2616828
9	8.7399691	9.9993433	8.7406258	11.2593742
10	8.7422586	9.9993364	8.7429222	11.2570778
11	8.7445360	9.9993293	8.7452067	11.2547933
12	8.7468015	9.9993223	8.7474792	11.2525208
13	8.7490553	9.9993152	8.7497400	11.2502600
14	8.7512973	9.9993081	8.7519892	11.2480108
15	8.7535278	9.9993009	8.7542269	11.2457731
16	8.7557469	9.9992938	8.7564531	11.2435469
17	8.7579546	9.9992865	8.7586681	11.2413319
18	8.7601512	9.9992793	8.7608719	11.2391281
19	8.7623366	9.9992720	8.7630647	11.2369353
20	8.7645111	9.9992646	8.7652465	11.2347535
21	8.7666747	9.9992572	8.7674175	11.2325825
22	8.7688275	9.9992498	8.7695777	11.2304223
23	8.7709697	9.9992424	8.7717274	11.2282726
24	8.7731014	9.9992349	8.7738665	11.2261335
25	8.7752226	9.9992274	8.7759952	11.2240048
26	8.7773334	9.9992198	8.7781136	11.2218864
27	8.7794340	9.9992122	8.7802218	11.2197782
28	8.7815244	9.9992046	8.7823199	11.2176801
29	8.7836048	9.9991969	8.7844079	11.2155921
30	8.7856753	9.9991892	8.7864861	11.2135139
31	8.7877359	9.9991815	8.7885544	11.2114456
32	8.7897867	9.9991737	8.7906130	11.2093870
33	8.7918278	9.9991659	8.7926620	11.2073380
34	8.7938594	9.9991580	8.7947014	11.2052986
35	8.7958814	9.9991501	8.7967313	11.2032687
36	8.7978941	9.9991422	8.7987519	11.2012481
37	8.7998974	9.9991342	8.8007632	11.1992368
38	8.8018915	9.9991262	8.8027653	11.1972347
39	8.8038764	9.9991182	8.8047583	11.1952417
40	8.8058523	9.9991101	8.8067422	11.1932578
41	8.8078192	9.9991020	8.8087172	11.1912828
42	8.8097772	9.9990938	8.8106834	11.1893166
43	8.8117264	9.9990856	8.8126407	11.1873593
44	8.8136668	9.9990774	8.8145894	11.1854106
45	8.8155985	9.9990691	8.8165294	11.1834706
46	8.8175217	9.9990608	8.8184608	11.1815392
47	8.8194363	9.9990525	8.8203838	11.1796162
48	8.8213425	9.9990441	8.8222984	11.1777016
49	8.8232404	9.9990357	8.8242046	11.1757954
50	8.8251299	9.9990273	8.8261026	11.1738974
51	8.8270112	9.9990188	8.8279924	11.1720076
52	8.8288844	9.9990103	8.8298741	11.1701259
53	8.8307495	9.9990017	8.8317478	11.1682522
54	8.8326066	9.9989931	8.8336134	11.1663866
55	8.8344557	9.9989845	8.8354712	11.1645288
56	8.8362969	9.9989758	8.8373211	11.1626789
57	8.8381304	9.9989671	8.8391633	11.1608367
58	8.8399561	9.9989584	8.8409977	11.1590023
59	8.8417741	9.9989496	8.8428245	11.1571755
60	8.8435845	9.9989408	8.8446437	11.1553563
	Cofine.	Sine.	Cotangent.	Tang.

86 Degrees.

Min.

SINES.

Min.	4 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	8.8435845	9.9989408	8.8446437	11.1553563	60
1	8.8453874	9.9989319	8.8464354	11.1535446	59
2	8.8471827	9.9989230	8.8482597	11.1517403	58
3	8.8489707	9.9989141	8.8500566	11.1499434	57
4	8.8507512	9.9989052	8.8518461	11.1481539	56
5	8.8525245	9.9988962	8.8536283	11.1463717	55
6	8.8542905	9.9988871	8.8554069	11.1445946	54
7	8.8560493	9.9988780	8.8571713	11.1428287	53
8	8.8578010	9.9988689	8.8589321	11.1410679	52
9	8.8595457	9.9988598	8.8606859	11.1393141	51
10	8.8612833	9.9988506	8.8624327	11.1375673	50
11	8.8630139	9.9988414	8.8641725	11.1358275	49
12	8.8647376	9.9988321	8.8659055	11.1340945	48
13	8.8664545	9.9988228	8.8676317	11.1323683	47
14	8.8681646	9.9988135	8.8693511	11.1306489	46
15	8.8698680	9.9988041	8.8710638	11.1289362	45
16	8.8715646	9.9987947	8.8727699	11.1272301	44
17	8.8732546	9.9987853	8.8744694	11.1255306	43
18	8.8749381	9.9987758	8.8761623	11.1238377	42
19	8.8766150	9.9987663	8.8778487	11.1221513	41
20	8.8782854	9.9987567	8.8795286	11.1204714	40
21	8.8799493	9.9987471	8.8812022	11.1187978	39
22	8.8816069	9.9987375	8.8828694	11.1171306	38
23	8.8832581	9.9987278	8.8845303	11.1154697	37
24	8.8849031	9.9987181	8.8861850	11.1138150	36
25	8.8865418	9.9987084	8.8878334	11.1121666	35
26	8.8881743	9.9986986	8.8894757	11.1105243	34
27	8.8898007	9.9986888	8.8911119	11.1088881	33
28	8.8914209	9.9986790	8.8927420	11.1072580	32
29	8.8930351	9.9986691	8.8943660	11.1056340	31
30	8.8946433	9.9986591	8.8959842	11.1040158	30
31	8.8962455	9.9986492	8.8975963	11.1024037	29
32	8.8978418	9.9986392	8.8992026	11.1007974	28
33	8.8994322	9.9986292	8.9008030	11.0991970	27
34	8.9010168	9.9986191	8.9023977	11.0976023	26
35	8.9025955	9.9986090	8.9039866	11.0960134	25
36	8.9041685	9.9985988	8.9055697	11.0944303	24
37	8.9057358	9.9985886	8.9071472	11.0928523	23
38	8.9072975	9.9985784	8.9087190	11.0912810	22
39	8.9088535	9.9985682	8.9102853	11.0897147	21
40	8.9104039	9.9985579	8.9118460	11.0881540	20
41	8.9119487	9.9985475	8.9134012	11.0865988	19
42	8.9134881	9.9985372	8.9149509	11.0850491	18
43	8.9150219	9.9985268	8.9164952	11.0835048	17
44	8.9165504	9.9985163	8.9180340	11.0819660	16
45	8.9180734	9.9985058	8.9195675	11.0804325	15
46	8.9195911	9.9984953	8.9210957	11.0789043	14
47	8.9211034	9.9984848	8.9226186	11.0773814	13
48	8.9226105	9.9984742	8.9241363	11.0758637	12
49	8.9241123	9.9984636	8.9256487	11.0743513	11
50	8.9256089	9.9984529	8.9271560	11.0728440	10
51	8.9271003	9.9984422	8.9286581	11.0713419	9
52	8.9285866	9.9984315	8.9301552	11.0698448	8
53	8.9300678	9.9984207	8.9316471	11.0683529	7
54	8.9315439	9.9984099	8.9331340	11.0668660	6
55	8.9330150	9.9983990	8.9346160	11.0653840	5
56	8.9344811	9.9983881	8.9360929	11.0639071	4
57	8.9359422	9.9983772	8.9375650	11.0624350	3
58	8.9373983	9.9983663	8.9390321	11.0609679	2
59	8.9388496	9.9983553	8.9404944	11.0595056	1
60	8.9402960	9.9983442	8.9419518	11.0580482	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

85 Degrees.

Min.	5 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	8.9402960	9.9983442	8.9419518	11.0580482	60
1	8.9417376	9.9983332	8.9434044	11.0565956	59
2	8.9431743	9.9983220	8.9448523	11.0551477	58
3	8.9446063	9.9983109	8.9462954	11.0537046	57
4	8.9460335	9.9982997	8.9477338	11.0522662	56
5	8.9474561	9.9982885	8.9491676	11.0508324	55
6	8.9488739	9.9982772	8.9505967	11.0494033	54
7	8.9502871	9.9982660	8.9520211	11.0479789	53
8	8.9516957	9.9982546	8.9534410	11.0465590	52
9	8.9530996	9.9982433	8.9548564	11.0451436	51
10	8.9544991	9.9982318	8.9562672	11.0437328	50
11	8.9558940	9.9982204	8.9576735	11.0423265	49
12	8.9572843	9.9982089	8.9590754	11.0409246	48
13	8.9586703	9.9981974	8.9604728	11.0395272	47
14	8.9600517	9.9981859	8.9618659	11.0381341	46
15	8.9614288	9.9981743	8.9632545	11.0367455	45
16	8.9628014	9.9981626	8.9646388	11.0353612	44
17	8.9641697	9.9981510	8.9660188	11.0339812	43
18	8.9655337	9.9981393	8.9673944	11.0326056	42
19	8.9668934	9.9981275	8.9687658	11.0312342	41
20	8.9682487	9.9981158	8.9701330	11.0298670	40
21	8.9695999	9.9981040	8.9714959	11.0285041	39
22	8.9709468	9.9980921	8.9728547	11.0271453	38
23	8.9722895	9.9980802	8.9742092	11.0257908	37
24	8.9736280	9.9980683	8.9755597	11.0244403	36
25	8.9749624	9.9980563	8.9769060	11.0230940	35
26	8.9762926	9.9980443	8.9782483	11.0217517	34
27	8.9776188	9.9980323	8.9795865	11.0204133	33
28	8.9789408	9.9980202	8.9809206	11.0190794	32
29	8.9802589	9.9980081	8.9822507	11.0177493	31
30	8.9815729	9.9979960	8.9835769	11.0164231	30
31	8.9828829	9.9979838	8.9848991	11.0151009	29
32	8.9841889	9.9979716	8.9862173	11.0137827	28
33	8.9854910	9.9979593	8.9875317	11.0124683	27
34	8.9867891	9.9979470	8.9888421	11.0111579	26
35	8.9880834	9.9979347	8.9901487	11.0098513	25
36	8.9893737	9.9979223	8.9914514	11.0085486	24
37	8.9906602	9.9979099	8.9927503	11.0072497	23
38	8.9919429	9.9978975	8.9940454	11.0059546	22
39	8.9932217	9.9978850	8.9953367	11.0046633	21
40	8.9944968	9.9978725	8.9966243	11.0033757	20
41	8.9957681	9.9978599	8.9979081	11.0020919	19
42	8.9970356	9.9978473	8.9991883	11.0008117	18
43	8.9982994	9.9978347	9.0004647	10.9995353	17
44	8.9995595	9.9978220	9.0017375	10.9982625	16
45	9.0008160	9.9978093	9.0030066	10.9969934	15
46	9.0020687	9.9977966	9.0042721	10.9957279	14
47	9.0033179	9.9977838	9.0055340	10.9944660	13
48	9.0045634	9.9977710	9.0067924	10.9932076	12
49	9.0058053	9.9977582	9.0080471	10.9919529	11
50	9.0070436	9.9977453	9.0092984	10.9907016	10
51	9.0082784	9.9977323	9.0105461	10.9894539	9
52	9.0095096	9.9977194	9.0117903	10.9882097	8
53	9.0107374	9.9977064	9.0130310	10.9869690	7
54	9.0119616	9.9976933	9.0142682	10.9857318	6
55	9.0131823	9.9976803	9.0155021	10.9844979	5
56	9.0143996	9.9976672	9.0167325	10.9832675	4
57	9.0156135	9.9976540	9.0179594	10.9820406	3
58	9.0168239	9.9976408	9.0191831	10.9808169	2
59	9.0180309	9.9976276	9.0204033	10.9795967	1
60	9.0192346	9.9976143	9.0216202	10.9783798	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

84 Degrees.

SINES.

Min.	6 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.0192346	9.9976143	9.0216202	10.9783798	60
1	9.0204348	9.9976011	9.0228338	10.9771662	59
2	9.0216318	9.9975877	9.0240441	10.9759559	58
3	9.0228254	9.9975743	9.0252510	10.9747490	57
4	9.0240157	9.9975609	9.0264548	10.9735452	56
5	9.0252027	9.9975475	9.0276552	10.9723448	55
6	9.0263865	9.9975340	9.0288524	10.9711476	54
7	9.0275669	9.9975205	9.0300464	10.9699536	53
8	9.0287442	9.9975069	9.0312373	10.9687627	52
9	9.0299182	9.9974933	9.0324249	10.9675751	51
10	9.0310890	9.9974797	9.0336093	10.9663907	50
11	9.0322567	9.9974660	9.0347906	10.9652094	49
12	9.0334212	9.9974523	9.0359688	10.9640312	48
13	9.0345825	9.9974386	9.0371439	10.9628561	47
14	9.0357407	9.9974248	9.0383159	10.9616841	46
15	9.0368958	9.9974110	9.0394848	10.9605152	45
16	9.0380477	9.9973971	9.0406506	10.9593494	44
17	9.0391966	9.9973833	9.0418134	10.9581866	43
18	9.0403424	9.9973693	9.0429731	10.9570269	42
19	9.0414852	9.9973554	9.0441299	10.9558701	41
20	9.0426249	9.9973414	9.0452836	10.9547164	40
21	9.0437617	9.9973273	9.0464343	10.9535657	39
22	9.0448954	9.9973132	9.0475821	10.9524179	38
23	9.0460261	9.9972991	9.0487270	10.9512730	37
24	9.0471538	9.9972850	9.0498689	10.9501311	36
25	9.0482786	9.9972708	9.0510078	10.9489922	35
26	9.0494005	9.9972566	9.0521439	10.9478561	34
27	9.0505194	9.9972423	9.0532771	10.9467229	33
28	9.0516354	9.9972280	9.0544074	10.9455926	32
29	9.0527485	9.9972137	9.0555349	10.9444651	31
30	9.0538588	9.9971993	9.0566595	10.9433405	30
31	9.0549661	9.9971849	9.0577813	10.9422187	29
32	9.0560706	9.9971704	9.0589002	10.9410998	28
33	9.0571723	9.9971559	9.0600164	10.9399836	27
34	9.0582711	9.9971414	9.0611297	10.9388703	26
35	9.0593672	9.9971268	9.0622403	10.9377597	25
36	9.0604604	9.9971122	9.0633482	10.9366518	24
37	9.0615509	9.9970976	9.0644533	10.9355467	23
38	9.0626386	9.9970829	9.0655556	10.9344444	22
39	9.0637235	9.9970682	9.0666553	10.9333447	21
40	9.0648057	9.9970535	9.0677522	10.9322478	20
41	9.0658852	9.9970387	9.0688465	10.9311535	19
42	9.0669619	9.9970239	9.0699381	10.9300619	18
43	9.0680360	9.9970090	9.0710270	10.9289730	17
44	9.0691074	9.9969941	9.0721133	10.9278867	16
45	9.0701761	9.9969792	9.0731969	10.9268031	15
46	9.0712421	9.9969642	9.0742779	10.9257221	14
47	9.0723055	9.9969493	9.0753563	10.9246437	13
48	9.0733663	9.9969342	9.0764321	10.9235679	12
49	9.0744244	9.9969191	9.0775053	10.9224947	11
50	9.0754799	9.9969040	9.0785760	10.9214240	10
51	9.0765329	9.9968888	9.0796441	10.9203559	9
52	9.0775832	9.9968736	9.0807096	10.9192904	8
53	9.0786310	9.9968584	9.0817726	10.9182274	7
54	9.0796762	9.9968431	9.0828331	10.9171669	6
55	9.0807189	9.9968278	9.0838911	10.9161080	5
56	9.0817590	9.9968125	9.0849466	10.9150534	4
57	9.0827966	9.9967971	9.0859996	10.9140004	3
58	9.0838317	9.9967817	9.0870501	10.9129499	2
59	9.0848643	9.9967662	9.0880981	10.9119019	1
60	9.0858945	9.9967507	9.0891438	10.9108562	0
	Cofine.	Sine.	Cotangent.	Tang.	

53 Degrees.

Min.	7 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.0858945	9.9967507	9.0891438	10.9108562	60
1	9.0869221	9.9967352	9.0901869	10.9098131	59
2	9.0879473	9.9967196	9.0912277	10.9087723	58
3	9.0889700	9.9967040	9.0922660	10.9077340	57
4	9.0899903	9.9966884	9.0933020	10.9066980	56
5	9.0910082	9.9966727	9.0943355	10.9056645	55
6	9.0920237	9.9966570	9.0953667	10.9046333	54
7	9.0930367	9.9966412	9.0963955	10.9036045	53
8	9.0940474	9.9966254	9.0974219	10.9025781	52
9	9.0950556	9.9966096	9.0984460	10.9015540	51
10	9.0960615	9.9965937	9.0994678	10.9005322	50
11	9.0970651	9.9965778	9.1004872	10.8995128	49
12	9.0980662	9.9965619	9.1015044	10.8984956	48
13	9.0990651	9.9965459	9.1025192	10.8974808	47
14	9.1000616	9.9965299	9.1035317	10.8964683	46
15	9.1010558	9.9965138	9.1045420	10.8954580	45
16	9.1020477	9.9964977	9.1055500	10.8944500	44
17	9.1030373	9.9964816	9.1065557	10.8934443	43
18	9.1040246	9.9964655	9.1075591	10.8924409	42
19	9.1050096	9.9964493	9.1085604	10.8914396	41
20	9.1059924	9.9964330	9.1095594	10.8904406	40
21	9.1069729	9.9964167	9.1105562	10.8894438	39
22	9.1079512	9.9964004	9.1115508	10.8884492	38
23	9.1089272	9.9963841	9.1125431	10.8874569	37
24	9.1099010	9.9963677	9.1135333	10.8864667	36
25	9.1108726	9.9963513	9.1145213	10.8854787	35
26	9.1118420	9.9963348	9.1155072	10.8844928	34
27	9.1128092	9.9963183	9.1164909	10.8835091	33
28	9.1137742	9.9963018	9.1174724	10.8825276	32
29	9.1147370	9.9962852	9.1184518	10.8815482	31
30	9.1156977	9.9962686	9.1194291	10.8805709	30
31	9.1166562	9.9962519	9.1204043	10.8795957	29
32	9.1176125	9.9962352	9.1213773	10.8786227	28
33	9.1185667	9.9962185	9.1223482	10.8776518	27
34	9.1195188	9.9962017	9.1233171	10.8766829	26
35	9.1204688	9.9961849	9.1242830	10.8757161	25
36	9.1214167	9.9961681	9.1252486	10.8747514	24
37	9.1223624	9.9961512	9.1262112	10.8737888	23
38	9.1233061	9.9961343	9.1271718	10.8728282	22
39	9.1242477	9.9961174	9.1281303	10.8718697	21
40	9.1251872	9.9961004	9.1290868	10.8709132	20
41	9.1261246	9.9960834	9.1300413	10.8699587	19
42	9.1270600	9.9960663	9.1309937	10.8690063	18
43	9.1279934	9.9960492	9.1319442	10.8680558	17
44	9.1289247	9.9960321	9.1328926	10.8671074	16
45	9.1298539	9.9960149	9.1338391	10.8661609	15
46	9.1307812	9.9959977	9.1347835	10.8652165	14
47	9.1317064	9.9959804	9.1357260	10.8642740	13
48	9.1326297	9.9959631	9.1366665	10.8633335	12
49	9.1335509	9.9959458	9.1376051	10.8623949	11
50	9.1344702	9.9959284	9.1385417	10.8614583	10
51	9.1353875	9.9959111	9.1394764	10.8605236	9
52	9.1363028	9.9958936	9.1404092	10.8595908	8
53	9.1372161	9.9958761	9.1413400	10.8586600	7
54	9.1381275	9.9958586	9.1422689	10.8577311	6
55	9.1390370	9.9958411	9.1431959	10.8568041	5
56	9.1399445	9.9958235	9.1441210	10.8558790	4
57	9.1408501	9.9958059	9.1450442	10.8549558	3
58	9.1417537	9.9957882	9.1459655	10.8540345	2
59	9.1426555	9.9957705	9.1468849	10.8531151	1
60	9.1435553	9.9957528	9.1478025	10.8521975	0
	Cofine.	Sine.	Cotangent.	Tang.	

62 Degrees.

SINES.

Min.	8 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.1435553	9.9957528	9.1478025	10.8521975	60
1	9.1444532	9.9957350	9.1487182	10.8512818	59
2	9.1453493	9.9957172	9.1496321	10.8503679	58
3	9.1462435	9.9956993	9.1505441	10.8494559	57
4	9.1471358	9.9956815	9.1514543	10.8485457	56
5	9.1480262	9.9956635	9.1523627	10.8476373	55
6	9.1489148	9.9956456	9.1532692	10.8467308	54
7	9.1498015	9.9956276	9.1541739	10.8458261	53
8	9.1506864	9.9956095	9.1550769	10.8449231	52
9	9.1515694	9.9955915	9.1559780	10.8440220	51
10	9.1524507	9.9955734	9.1568773	10.8431227	50
11	9.1533301	9.9955552	9.1577748	10.8422252	49
12	9.1542076	9.9955370	9.1586706	10.8413294	48
13	9.1550834	9.9955188	9.1595646	10.8404354	47
14	9.1559574	9.9955005	9.1604569	10.8395431	46
15	9.1568296	9.9954822	9.1613473	10.8386527	45
16	9.1577000	9.9954639	9.1622361	10.8377639	44
17	9.1585686	9.9954455	9.1631231	10.8368769	43
18	9.1594354	9.9954271	9.1640083	10.8359917	42
19	9.1603005	9.9954087	9.1648919	10.8351081	41
20	9.1611639	9.9953902	9.1657737	10.8342263	40
21	9.1620254	9.9953717	9.1666538	10.8333462	39
22	9.1628853	9.9953531	9.1675322	10.8324678	38
23	9.1637434	9.9953345	9.1684098	10.8315911	37
24	9.1645998	9.9953159	9.1692839	10.8307161	36
25	9.1654544	9.9952972	9.1701572	10.8298428	35
26	9.1663074	9.9952785	9.1710289	10.8289711	34
27	9.1671586	9.9952597	9.1718989	10.8281011	33
28	9.1680081	9.9952409	9.1727672	10.8272328	32
29	9.1688559	9.9952221	9.1736338	10.8263662	31
30	9.1697021	9.9952033	9.1744988	10.8255012	30
31	9.1705465	9.9951844	9.1753622	10.8246378	29
32	9.1713893	9.9951654	9.1762239	10.8237761	28
33	9.1722305	9.9951464	9.1770840	10.8229160	27
34	9.1730699	9.9951274	9.1779425	10.8220575	26
35	9.1739077	9.9951084	9.1787993	10.8212007	25
36	9.1747439	9.9950893	9.1796546	10.8203454	24
37	9.1755784	9.9950702	9.1805082	10.8194918	23
38	9.1764112	9.9950510	9.1813602	10.8186398	22
39	9.1772425	9.9950318	9.1822106	10.8177894	21
40	9.1780721	9.9950126	9.1830595	10.8169405	20
41	9.1789001	9.9949933	9.1839069	10.8160932	19
42	9.1797265	9.9949740	9.1847525	10.8152475	18
43	9.1805512	9.9949546	9.1855966	10.8144034	17
44	9.1813744	9.9949352	9.1864392	10.8135608	16
45	9.1821960	9.9949158	9.1872802	10.8127198	15
46	9.1830160	9.9948964	9.1881196	10.8118804	14
47	9.1838344	9.9948769	9.1889575	10.8110425	13
48	9.1846512	9.9948573	9.1897939	10.8102061	12
49	9.1854665	9.9948377	9.1906287	10.8093713	11
50	9.1862802	9.9948181	9.1914621	10.8085379	10
51	9.1870923	9.9947985	9.1922939	10.8077061	9
52	9.1879029	9.9947788	9.1931241	10.8068759	8
53	9.1887120	9.9947591	9.1939529	10.8060471	7
54	9.1895195	9.9947393	9.1947802	10.8052198	6
55	9.1903254	9.9947195	9.1956059	10.8043941	5
56	9.1911299	9.9946997	9.1964302	10.8035698	4
57	9.1919328	9.9946798	9.1972530	10.8027470	3
58	9.1927342	9.9946599	9.1980743	10.8019257	2
59	9.1935341	9.9946399	9.1988941	10.8011059	1
60	9.1943324	9.9946199	9.1997125	10.8002875	0
	Cofine.	Sine.	Cotangent.	Tang.	

81 Degrees.

Min.	9 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.1943324	9.9946199	9.1997125	10.8002875	60
1	9.1951293	9.9945999	9.2005294	10.7994706	59
2	9.1959247	9.9945798	9.2013449	10.7986551	58
3	9.1967186	9.9945597	9.2021588	10.7978412	57
4	9.1975110	9.9945396	9.2029714	10.7970286	56
5	9.1983019	9.9945194	9.2037825	10.7962175	55
6	9.1990913	9.9944992	9.2045922	10.7954078	54
7	9.1998793	9.9944789	9.2054004	10.7945996	53
8	9.2006658	9.9944587	9.2062072	10.7937928	52
9	9.2014509	9.9944383	9.2070126	10.7929874	51
10	9.2022345	9.9944180	9.2078165	10.7921835	50
11	9.2030167	9.9943975	9.2086191	10.7913809	49
12	9.2037971	9.9943771	9.2094203	10.7905797	48
13	9.2045766	9.9943566	9.2102200	10.7897800	47
14	9.2053545	9.9943361	9.2110184	10.7889816	46
15	9.2061309	9.9943156	9.2118153	10.7881847	45
16	9.2069059	9.9942950	9.2126109	10.7873891	44
17	9.2076795	9.9942743	9.2134051	10.7865949	43
18	9.2084516	9.9942537	9.2141980	10.7858020	42
19	9.2092224	9.9942330	9.2149894	10.7850106	41
20	9.2099917	9.9942122	9.2157795	10.7842205	40
21	9.2107597	9.9941914	9.2165683	10.7834317	39
22	9.2115263	9.9941706	9.2173556	10.7826444	38
23	9.2122914	9.9941498	9.2181417	10.7818583	37
24	9.2130552	9.9941289	9.2189264	10.7810736	36
25	9.2138176	9.9941079	9.2197097	10.7802903	35
26	9.2145787	9.9940870	9.2204917	10.7795083	34
27	9.2153384	9.9940659	9.2212724	10.7787276	33
28	9.2160967	9.9940449	9.2220518	10.7779482	32
29	9.2168536	9.9940238	9.2228298	10.7771702	31
30	9.2176092	9.9940027	9.2236065	10.7763935	30
31	9.2183635	9.9939815	9.2243819	10.7756181	29
32	9.2191164	9.9939603	9.2251561	10.7748439	28
33	9.2198680	9.9939391	9.2259289	10.7740711	27
34	9.2206182	9.9939178	9.2267004	10.7732996	26
35	9.2213671	9.9938965	9.2274706	10.7725294	25
36	9.2221147	9.9938752	9.2282395	10.7717605	24
37	9.2228609	9.9938538	9.2290071	10.7709929	23
38	9.2236059	9.9938324	9.2297735	10.7702265	22
39	9.2243495	9.9938109	9.2305386	10.7694614	21
40	9.2250918	9.9937894	9.2313024	10.7686976	20
41	9.2258328	9.9937679	9.2320650	10.7679350	19
42	9.2265725	9.9937463	9.2328262	10.7671738	18
43	9.2273110	9.9937247	9.2335863	10.7664137	17
44	9.2280481	9.9937033	9.2343451	10.7656549	16
45	9.2287839	9.9936813	9.2351026	10.7648974	15
46	9.2295185	9.9936596	9.2358589	10.7641411	14
47	9.2302518	9.9936378	9.2366139	10.7633861	13
48	9.2309838	9.9936160	9.2373678	10.7626322	12
49	9.2317145	9.9935942	9.2381203	10.7618797	11
50	9.2324440	9.9935723	9.2388717	10.7611283	10
51	9.2331722	9.9935504	9.2396218	10.7603782	9
52	9.2338992	9.9935285	9.2403708	10.7596292	8
53	9.2346249	9.9935065	9.2411185	10.7588815	7
54	9.2353494	9.9934844	9.2418650	10.7581350	6
55	9.2360726	9.9934624	9.2426103	10.7573897	5
56	9.2367946	9.9934403	9.2433543	10.7566457	4
57	9.2375153	9.9934181	9.2440972	10.7559028	3
58	9.2382349	9.9933959	9.2448389	10.7551611	2
59	9.2389532	9.9933737	9.2455794	10.7544206	1
60	9.2396702	9.9933515	9.2463188	10.7536812	0
	Cofine.	Sine.	Cotangent.	Tang.	

80 Degrees.

SINES.

Min.	10 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.2396702	9.9933515	9.2463188	10.7536812	60
1	9.2403861	9.9933292	9.2470569	10.7539431	59
2	9.2411007	9.9933068	9.2477939	10.7542061	58
3	9.2418141	9.9932845	9.2485297	10.7544703	57
4	9.2425264	9.9932621	9.2492643	10.7547357	56
5	9.2432374	9.9932396	9.2499978	10.7550022	55
6	9.2439472	9.9932171	9.2507301	10.7492699	54
7	9.2446558	9.9931946	9.2514612	10.7485388	53
8	9.2453632	9.9931720	9.2521912	10.7478088	52
9	9.2460695	9.9931494	9.2529200	10.7470800	51
10	9.2467746	9.9931268	9.2536477	10.7463523	50
11	9.2474784	9.9931041	9.2543743	10.7456257	49
12	9.2481811	9.9930814	9.2550997	10.7449003	48
13	9.2488827	9.9930587	9.2558240	10.7441760	47
14	9.2495830	9.9930359	9.2565472	10.7434528	46
15	9.2502822	9.9930131	9.2572692	10.7427308	45
16	9.2509803	9.9929902	9.2579901	10.7420099	44
17	9.2516772	9.9929673	9.2587099	10.7412801	43
18	9.2523729	9.9929444	9.2594285	10.7405515	42
19	9.2530675	9.9929214	9.2601461	10.7398239	41
20	9.2537609	9.9928984	9.2608625	10.7390975	40
21	9.2544532	9.9928753	9.2615779	10.7383721	39
22	9.2551444	9.9928522	9.2622921	10.7376479	38
23	9.2558344	9.9928291	9.2630053	10.7369247	37
24	9.2565233	9.9928059	9.2637173	10.7362027	36
25	9.2572110	9.9927827	9.2644283	10.7354817	35
26	9.2578977	9.9927595	9.2651382	10.7347618	34
27	9.2585832	9.9927362	9.2658470	10.7340430	33
28	9.2592676	9.9927129	9.2665547	10.7333253	32
29	9.2599509	9.9926895	9.2672613	10.7326087	31
30	9.2606330	9.9926661	9.2679669	10.7318931	30
31	9.2613141	9.9926427	9.2686714	10.7311786	29
32	9.2619941	9.9926192	9.2693749	10.7304651	28
33	9.2626729	9.9925957	9.2700772	10.7297528	27
34	9.2633507	9.9925722	9.2707786	10.7290414	26
35	9.2640274	9.9925486	9.2714788	10.7283312	25
36	9.2647030	9.9925250	9.2721780	10.7276220	24
37	9.2653775	9.9925013	9.2728762	10.7269138	23
38	9.2660509	9.9924776	9.2735733	10.7262067	22
39	9.2667232	9.9924539	9.2742694	10.7255006	21
40	9.2673945	9.9924301	9.2749644	10.7247956	20
41	9.2680647	9.9924063	9.2756584	10.7240916	19
42	9.2687338	9.9923824	9.2763514	10.7233886	18
43	9.2694019	9.9923585	9.2770434	10.7226866	17
44	9.2700689	9.9923346	9.2777343	10.7219856	16
45	9.2707348	9.9923106	9.2784242	10.7212856	15
46	9.2713997	9.9922866	9.2791131	10.7205866	14
47	9.2720635	9.9922626	9.2798009	10.7198886	13
48	9.2727263	9.9922385	9.2804878	10.7191916	12
49	9.2733880	9.9922144	9.2811736	10.7184956	11
50	9.2740487	9.9921902	9.2818585	10.7178006	10
51	9.2747083	9.9921660	9.2825423	10.7171066	9
52	9.2753669	9.9921418	9.2832251	10.7164136	8
53	9.2760245	9.9921175	9.2839070	10.7157216	7
54	9.2766811	9.9920932	9.2845878	10.7150306	6
55	9.2773366	9.9920689	9.2852677	10.7143406	5
56	9.2779911	9.9920445	9.2859466	10.7136516	4
57	9.2786445	9.9920201	9.2866245	10.7129636	3
58	9.2792970	9.9919956	9.2873014	10.7122766	2
59	9.2799484	9.9919711	9.2879773	10.7115906	1
60	9.2805988	9.9919466	9.2886523	10.7109056	0
	Cofine.	Sine.	Cotangent.	Tang.	

79 Degrees.

Min.	11 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.2805988	9.9919466	9.2886523	10.7113477	60
1	9.2812483	9.9919220	9.2893263	10.7106737	59
2	9.2818967	9.9918974	9.2899993	10.7100007	58
3	9.2825441	9.9918727	9.2906713	10.7093287	57
4	9.2831905	9.9918480	9.2913424	10.7086576	56
5	9.2838359	9.9918233	9.2920126	10.7079874	55
6	9.2844803	9.9917986	9.2926817	10.7073183	54
7	9.2851237	9.9917737	9.2933500	10.7066500	53
8	9.2857661	9.9917489	9.2940172	10.7059828	52
9	9.2864076	9.9917240	9.2946836	10.7053164	51
10	9.2870480	9.9916991	9.2953489	10.7046511	50
11	9.2876875	9.9916741	9.2960134	10.7039866	49
12	9.2883260	9.9916492	9.2966769	10.7033231	48
13	9.2889636	9.9916241	9.2973395	10.7026605	47
14	9.2896001	9.9915990	9.2980011	10.7020089	46
15	9.2902357	9.9915739	9.2986618	10.7013582	45
16	9.2908704	9.9915488	9.2993216	10.7007084	44
17	9.2915040	9.9915236	9.2999804	10.7000596	43
18	9.2921367	9.9914984	9.3006383	10.6994112	42
19	9.2927685	9.9914731	9.3012954	10.6987640	41
20	9.2933993	9.9914478	9.3019514	10.6981176	40
21	9.2940291	9.9914225	9.3026066	10.6974720	39
22	9.2946580	9.9913971	9.3032609	10.6968272	38
23	9.2952859	9.9913717	9.3039143	10.6961832	37
24	9.2959129	9.9913462	9.3045667	10.6955400	36
25	9.2965390	9.9913207	9.3052183	10.6948976	35
26	9.2971641	9.9912952	9.3058689	10.6942560	34
27	9.2977883	9.9912696	9.3065187	10.6936152	33
28	9.2984116	9.9912440	9.3071675	10.6929752	32
29	9.2990339	9.9912184	9.3078155	10.6923360	31
30	9.2996553	9.9911927	9.3084626	10.6916976	30
31	9.3002758	9.9911670	9.3091088	10.6910600	29
32	9.3008953	9.9911412	9.3097541	10.6904232	28
33	9.3015140	9.9911154	9.3103985	10.6897872	27
34	9.3021317	9.9910896	9.3110421	10.6891520	26
35	9.3027485	9.9910637	9.3116848	10.6885176	25
36	9.3033644	9.9910379	9.3123266	10.6878840	24
37	9.3039794	9.9910119	9.3129675	10.6872512	23
38	9.3045934	9.9909859	9.3136076	10.6866192	22
39	9.3052066	9.9909598	9.3142468	10.6859880	21
40	9.3058189	9.9909338	9.3148851	10.6853576	20
41	9.3064303	9.9909077	9.3155226	10.6847280	19
42	9.3070407	9.9908815	9.3161592	10.6840992	18
43	9.3076503	9.9908553	9.3167950	10.6834712	17
44	9.3082590	9.9908291	9.3174299	10.6828440	16
45	9.3088668	9.9908029	9.3180640	10.6822176	15
46	9.3094737	9.9907766	9.3186972	10.6815920	14
47	9.3100798	9.9907502	9.3193295	10.6809672	13
48	9.3106849	9.9907239	9.3199611	10.6803432	12
49	9.3112892	9.9906974	9.3205918	10.6797200	11
50	9.3118926	9.9906710	9.3212216	10.6790976	10
51	9.3124951	9.9906445	9.3218506	10.6784760	9
52	9.3130968	9.9906180	9.3224788	10.6778552	8
53	9.3136976	9.9905914	9.3231061	10.6772352	7
54	9.3142975	9.9905648	9.3237327	10.6766160	6
55	9.3148965	9.9905382	9.3243584	10.6759976	5
56	9.3154947	9.9905115	9.3249832	10.6753800	4
57	9.3160921	9.9904848	9.3256073	10.6747632	3
58	9.3166885	9.9904580	9.3262305	10.6741472	2
59	9.3172841	9.9904312	9.3268529	10.6735320	1
60	9.3178789	9.9904044	9.3274745	10.6729176	0
	Cofine.	Sine.	Cotangent.	Tang.	

78 Degrees.

SINES.

Min.	12 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.3178789	9.9904044	9.3274745	10.6725255	60
1	9.3184728	9.9903775	9.3280953	10.6719047	59
2	9.3190659	9.9903506	9.3287153	10.6712847	58
3	9.3196581	9.9903237	9.3293345	10.6706655	57
4	9.3202495	9.9902967	9.3299528	10.6700472	56
5	9.3208400	9.9902697	9.3305704	10.6694296	55
6	9.3214297	9.9902426	9.3311872	10.6688128	54
7	9.3220186	9.9902155	9.3318031	10.6681969	53
8	9.3226066	9.9901883	9.3324183	10.6675817	52
9	9.3231938	9.9901612	9.3330327	10.6669673	51
10	9.3237802	9.9901339	9.3336463	10.6663537	50
11	9.3243657	9.9901067	9.3342591	10.6657409	49
12	9.3249505	9.9900794	9.3348711	10.6651289	48
13	9.3255344	9.9900521	9.3354823	10.6645177	47
14	9.3261174	9.9900247	9.3360927	10.6639073	46
15	9.3266997	9.9899973	9.3367024	10.6632976	45
16	9.3272811	9.9899698	9.3373113	10.6626887	44
17	9.3278617	9.9899423	9.3379194	10.6620806	43
18	9.3284416	9.9899148	9.3385267	10.6614733	42
19	9.3290206	9.9898873	9.3391333	10.6608667	41
20	9.3295988	9.9898597	9.3397391	10.6602609	40
21	9.3301761	9.9898320	9.3403441	10.6596559	39
22	9.3307527	9.9898043	9.3409484	10.6590516	38
23	9.3313285	9.9897766	9.3415519	10.6584481	37
24	9.3319059	9.9897489	9.3421546	10.6578454	36
25	9.3324777	9.9897211	9.3427566	10.6572434	35
26	9.3330511	9.9896932	9.3433578	10.6566422	34
27	9.3336237	9.9896654	9.3439583	10.6560417	33
28	9.3341955	9.9896374	9.3445580	10.6554420	32
29	9.3347665	9.9896095	9.3451570	10.6548430	31
30	9.3353368	9.9895815	9.3457552	10.6542448	30
31	9.3359062	9.9895535	9.3463527	10.6536473	29
32	9.3364749	9.9895254	9.3469494	10.6530506	28
33	9.3370428	9.9894973	9.3475454	10.6524546	27
34	9.3376099	9.9894692	9.3481407	10.6518593	26
35	9.3381762	9.9894410	9.3487352	10.6512648	25
36	9.3387418	9.9894128	9.3493290	10.6506710	24
37	9.3393065	9.9893845	9.3499220	10.6500780	23
38	9.3398706	9.9893562	9.3505143	10.6494857	22
39	9.3404338	9.9893279	9.3511059	10.6488941	21
40	9.3409963	9.9892995	9.3516968	10.6483032	20
41	9.3415580	9.9892711	9.3522869	10.6477131	19
42	9.3421190	9.9892427	9.3528763	10.6471237	18
43	9.3426792	9.9892142	9.3534650	10.6465350	17
44	9.3432386	9.9891856	9.3540530	10.6459470	16
45	9.3437973	9.9891571	9.3546402	10.6453598	15
46	9.3443552	9.9891285	9.3552267	10.6447733	14
47	9.3449124	9.9890998	9.3558126	10.6441874	13
48	9.3454688	9.9890711	9.3563977	10.6436023	12
49	9.3460245	9.9890424	9.3569821	10.6430179	11
50	9.3465794	9.9890137	9.3575658	10.6424342	10
51	9.3471336	9.9889849	9.3581487	10.6418513	9
52	9.3476870	9.9889560	9.3587310	10.6412690	8
53	9.3482397	9.9889271	9.3593126	10.6406874	7
54	9.3487917	9.9888982	9.3598935	10.6401065	6
55	9.3493429	9.9888693	9.3604736	10.6395264	5
56	9.3498934	9.9888403	9.3610531	10.6389469	4
57	9.3504432	9.9888113	9.3616319	10.6383681	3
58	9.3509922	9.9887822	9.3622100	10.6377900	2
59	9.3515405	9.9887531	9.3627874	10.6372126	1
60	9.3520880	9.9887239	9.3633641	10.6366359	0
	Cofine.	Sine.	Cotangent.	Tang.	

77 Degrees.

Min.	13 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.3520880	9.9887239	9.3633641	10.6366359	60
1	9.3526349	9.9886947	9.3639401	10.6360599	59
2	9.3531810	9.9886655	9.3645155	10.6354845	58
3	9.3537264	9.9886363	9.3650901	10.6349099	57
4	9.3542710	9.9886070	9.3656641	10.6343359	56
5	9.3548150	9.9885776	9.3662374	10.6337626	55
6	9.3553582	9.9885482	9.3668100	10.6331900	54
7	9.3559007	9.9885188	9.3673819	10.6326181	53
8	9.3564426	9.9884894	9.3679532	10.6320468	52
9	9.3569836	9.9884599	9.3685238	10.6314762	51
10	9.3575249	9.9884303	9.3690937	10.6309063	50
11	9.3580637	9.9884008	9.3696629	10.6303371	49
12	9.3586027	9.9883712	9.3702315	10.6297685	48
13	9.3591409	9.9883415	9.3707994	10.6292006	47
14	9.3596785	9.9883118	9.3713667	10.6286333	46
15	9.3602154	9.9882821	9.3719333	10.6280667	45
16	9.3607515	9.9882523	9.3724992	10.6275008	44
17	9.3612870	9.9882225	9.3730645	10.6269355	43
18	9.3618217	9.9881927	9.3736291	10.6263709	42
19	9.3623558	9.9881628	9.3741930	10.6258070	41
20	9.3628892	9.9881329	9.3747563	10.6252437	40
21	9.3634219	9.9881029	9.3753190	10.6246810	39
22	9.3639539	9.9880729	9.3758810	10.6241190	38
23	9.3644852	9.9880429	9.3764423	10.6235577	37
24	9.3650158	9.9880128	9.3770030	10.6229970	36
25	9.3655458	9.9879827	9.3775631	10.6224369	35
26	9.3660750	9.9879525	9.3781225	10.6218775	34
27	9.3666036	9.9879223	9.3786813	10.6213187	33
28	9.3671315	9.9878921	9.3792394	10.6207606	32
29	9.3676587	9.9878618	9.3797969	10.6202031	31
30	9.3681853	9.9878315	9.3803537	10.6196463	30
31	9.3687111	9.9878012	9.3809100	10.6190900	29
32	9.3692363	9.9877708	9.3814655	10.6185345	28
33	9.3697608	9.9877404	9.3820205	10.6179795	27
34	9.3702847	9.9877099	9.3825748	10.6174252	26
35	9.3708079	9.9876794	9.3831285	10.6168715	25
36	9.3713304	9.9876488	9.3836816	10.6163184	24
37	9.3718523	9.9876183	9.3842340	10.6157660	23
38	9.3723735	9.9875876	9.3847858	10.6152142	22
39	9.3728940	9.9875570	9.3853370	10.6146630	21
40	9.3734139	9.9875263	9.3858876	10.6141124	20
41	9.3739331	9.9874955	9.3864376	10.6135624	19
42	9.3744517	9.9874648	9.3869869	10.6130131	18
43	9.3749696	9.9874339	9.3875356	10.6124644	17
44	9.3754868	9.9874031	9.3880837	10.6119163	16
45	9.3760034	9.9873722	9.3886312	10.6113688	15
46	9.3765194	9.9873413	9.3891781	10.6108219	14
47	9.3770347	9.9873103	9.3897244	10.6102756	13
48	9.3775493	9.9872793	9.3902700	10.6097300	12
49	9.3780633	9.9872482	9.3908151	10.6091849	11
50	9.3785767	9.9872171	9.3913595	10.6086405	10
51	9.3790894	9.9871860	9.3919034	10.6080966	9
52	9.3796015	9.9871549	9.3924466	10.6075534	8
53	9.3801129	9.9871236	9.3929893	10.6070107	7
54	9.3806237	9.9870924	9.3935313	10.6064687	6
55	9.3811339	9.9870611	9.3940727	10.6059273	5
56	9.3816434	9.9870298	9.3946136	10.6053864	4
57	9.3821523	9.9869984	9.3951538	10.6048462	3
58	9.3826605	9.9869670	9.3956935	10.6043065	2
59	9.3831682	9.9869356	9.3962326	10.6037674	1
60	9.3836752	9.9869041	9.3967711	10.6032289	0
	Cofine.	Sine.	Cotangent.	Tang.	

76 Degrees.

SINES.

Min.	14 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.3836752	9.9869041	9.3967711	10.6032289	60
1	9.3841815	9.9868726	9.3973089	10.6026911	59
2	9.3846873	9.9868410	9.3978463	10.6021537	58
3	9.3851924	9.9868094	9.3983830	10.6016170	57
4	9.3856969	9.9867778	9.3989191	10.6010809	56
5	9.3862008	9.9867461	9.3994547	10.6005453	55
6	9.3867040	9.9867144	9.3999896	10.6000104	54
7	9.3872067	9.9866827	9.4005240	10.5994760	53
8	9.3877087	9.9866509	9.4010578	10.5989422	52
9	9.3882101	9.9866191	9.4015910	10.5984090	51
10	9.3887109	9.9865872	9.4021237	10.5978763	50
11	9.3892111	9.9865553	9.4026558	10.5973442	49
12	9.3897106	9.9865233	9.4031873	10.5968127	48
13	9.3902096	9.9864913	9.4037182	10.5962818	47
14	9.3907079	9.9864593	9.4042486	10.5957514	46
15	9.3912057	9.9864273	9.4047784	10.5952216	45
16	9.3917028	9.9863952	9.4053076	10.5946924	44
17	9.3921993	9.9863630	9.4058363	10.5941637	43
18	9.3926952	9.9863308	9.4063644	10.5936356	42
19	9.3931905	9.9862986	9.4068919	10.5931081	41
20	9.3936852	9.9862663	9.4074189	10.5925811	40
21	9.3941794	9.9862340	9.4079453	10.5920547	39
22	9.3946729	9.9862017	9.4084712	10.5915288	38
23	9.3951658	9.9861693	9.4089965	10.5910035	37
24	9.3956581	9.9861369	9.4095212	10.5904788	36
25	9.3961499	9.9861045	9.4100454	10.5899546	35
26	9.3966410	9.9860720	9.4105690	10.5894310	34
27	9.3971315	9.9860394	9.4110921	10.5889079	33
28	9.3976215	9.9860069	9.4116146	10.5883854	32
29	9.3981109	9.9859742	9.4121366	10.5878634	31
30	9.3985996	9.9859416	9.4126581	10.5873419	30
31	9.3990878	9.9859090	9.4131789	10.5868211	29
32	9.3995754	9.9858762	9.4136993	10.5863007	28
33	9.4000625	9.9858434	9.4142191	10.5857809	27
34	9.4005489	9.9858106	9.4147383	10.5852617	26
35	9.4010348	9.9857777	9.4152570	10.5847430	25
36	9.4015201	9.9857449	9.4157752	10.5842248	24
37	9.4020048	9.9857119	9.4162928	10.5837072	23
38	9.4024889	9.9856790	9.4168099	10.5831901	22
39	9.4029724	9.9856460	9.4173265	10.5826735	21
40	9.4034554	9.9856129	9.4178425	10.5821575	20
41	9.4039378	9.9855798	9.4183580	10.5816420	19
42	9.4044196	9.9855467	9.4188729	10.5811271	18
43	9.4049009	9.9855135	9.4193874	10.5806126	17
44	9.4053816	9.9854803	9.4199013	10.5800987	16
45	9.4058617	9.9854471	9.4204146	10.5795854	15
46	9.4063413	9.9854138	9.4209275	10.5790725	14
47	9.4068203	9.9853805	9.4214398	10.5785602	13
48	9.4072987	9.9853471	9.4219515	10.5780485	12
49	9.4077766	9.9853138	9.4224628	10.5775372	11
50	9.4082539	9.9852803	9.4229735	10.5770265	10
51	9.4087306	9.9852468	9.4234838	10.5765162	9
52	9.4092068	9.9852133	9.4239935	10.5760065	8
53	9.4096824	9.9851798	9.4245026	10.5754974	7
54	9.4101575	9.9851462	9.4250113	10.5749887	6
55	9.4106320	9.9851125	9.4255194	10.5744806	5
56	9.4111059	9.9850789	9.4260271	10.5739729	4
57	9.4115793	9.9850452	9.4265342	10.5734658	3
58	9.4120522	9.9850114	9.4270408	10.5729592	2
59	9.4125245	9.9849776	9.4275469	10.5724531	1
60	9.4129962	9.9849438	9.4280525	10.5719475	0
	Cofine.	Sine.	Cotangent.	Tang.	

75 Degrees.

Min.	15 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.4129962	9.9849438	9.4280525	10.5719475	60
1	9.4134674	9.9849099	9.4285575	10.5714425	59
2	9.4139381	9.9848760	9.4290621	10.5709379	58
3	9.4144082	9.9848420	9.4295661	10.5704339	57
4	9.4148778	9.9848081	9.4300697	10.5699303	56
5	9.4153468	9.9847740	9.4305727	10.5694273	55
6	9.4158152	9.9847400	9.4310753	10.5689247	54
7	9.4162832	9.9847059	9.4315773	10.5684227	53
8	9.4167506	9.9846717	9.4320789	10.5679211	52
9	9.4172174	9.9846375	9.4325799	10.5674201	51
10	9.4176837	9.9846033	9.4330804	10.5669196	50
11	9.4181495	9.9845690	9.4335805	10.5664195	49
12	9.4186148	9.9845347	9.4340800	10.5659200	48
13	9.4190795	9.9845004	9.4345791	10.5654209	47
14	9.4195436	9.9844660	9.4350776	10.5649224	46
15	9.4200073	9.9844316	9.4355757	10.5644243	45
16	9.4204704	9.9843971	9.4360733	10.5639267	44
17	9.4209330	9.9843626	9.4365704	10.5634296	43
18	9.4213950	9.9843281	9.4370670	10.5629330	42
19	9.4218566	9.9842935	9.4375631	10.5624369	41
20	9.4223176	9.9842589	9.4380587	10.5619413	40
21	9.4227780	9.9842242	9.4385538	10.5614462	39
22	9.4232380	9.9841895	9.4390485	10.5609515	38
23	9.4236974	9.9841548	9.4395426	10.5604574	37
24	9.4241563	9.9841200	9.4400363	10.5599637	36
25	9.4246147	9.9840852	9.4405295	10.5594705	35
26	9.4250726	9.9840503	9.4410222	10.5589778	34
27	9.4255299	9.9840154	9.4415145	10.5584855	33
28	9.4259867	9.9839805	9.4420062	10.5579938	32
29	9.4264430	9.9839455	9.4424975	10.5575025	31
30	9.4268988	9.9839105	9.4429883	10.5570117	30
31	9.4273541	9.9838755	9.4434786	10.5565214	29
32	9.4278089	9.9838404	9.4439685	10.5560315	28
33	9.4282631	9.9838052	9.4444579	10.5555421	27
34	9.4287169	9.9837701	9.4449468	10.5550532	26
35	9.4291701	9.9837348	9.4454352	10.5545648	25
36	9.4296228	9.9836996	9.4459232	10.5540768	24
37	9.4300750	9.9836643	9.4464107	10.5535893	23
38	9.4305267	9.9836290	9.4468978	10.5531022	22
39	9.4309779	9.9835936	9.4473843	10.5526157	21
40	9.4314286	9.9835582	9.4478704	10.5521296	20
41	9.4318788	9.9835227	9.4483561	10.5516439	19
42	9.4323285	9.9834872	9.4488413	10.5511587	18
43	9.4327777	9.9834517	9.4493260	10.5506740	17
44	9.4332264	9.9834161	9.4498102	10.5501898	16
45	9.4336746	9.9833805	9.4502940	10.5497060	15
46	9.4341223	9.9833449	9.4507774	10.5492226	14
47	9.4345694	9.9833092	9.4512602	10.5487398	13
48	9.4350161	9.9832735	9.4517427	10.5482573	12
49	9.4354623	9.9832377	9.4522246	10.5477754	11
50	9.4359080	9.9832019	9.4527061	10.5472939	10
51	9.4363532	9.9831661	9.4531872	10.5468128	9
52	9.4367980	9.9831302	9.4536678	10.5463322	8
53	9.4372422	9.9830942	9.4541479	10.5458521	7
54	9.4376859	9.9830583	9.4546276	10.5453724	6
55	9.4381292	9.9830223	9.4551069	10.5448931	5
56	9.4385719	9.9829862	9.4555857	10.5444143	4
57	9.4390142	9.9829501	9.4560641	10.5439359	3
58	9.4394560	9.9829140	9.4565420	10.5434580	2
59	9.4398973	9.9828778	9.4570194	10.5429806	1
60	9.4403381	9.9828416	9.4574964	10.5425036	0
	Cofine.	Sine.	Cotangent.	Tang.	

74 Degrees.

SINES.

Min.	16 Degrees.				
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.4403381	9.9828416	9.4574964	10.5425036	60
1	9.4407784	9.9828054	9.4579730	10.5420270	59
2	9.4412182	9.9827691	9.4584491	10.5415509	58
3	9.4416576	9.9827328	9.4589248	10.5410752	57
4	9.4420965	9.9826964	9.4594001	10.5405999	56
5	9.4425349	9.9826600	9.4598749	10.5401251	55
6	9.4429728	9.9826236	9.4603492	10.5396508	54
7	9.4434103	9.9825871	9.4608232	10.5391768	53
8	9.4438472	9.9825506	9.4612967	10.5387033	52
9	9.4442837	9.9825140	9.4617697	10.5382303	51
10	9.4447197	9.9824774	9.4622423	10.5377577	50
11	9.4451553	9.9824408	9.4627145	10.5372855	49
12	9.4455904	9.9824041	9.4631863	10.5368137	48
13	9.4460250	9.9823674	9.4636576	10.5363424	47
14	9.4464591	9.9823306	9.4641285	10.5358715	46
15	9.4468927	9.9822938	9.4645990	10.5354010	45
16	9.4473259	9.9822569	9.4650690	10.5349310	44
17	9.4477586	9.9822201	9.4655386	10.5344614	43
18	9.4481909	9.9821831	9.4660078	10.5339922	42
19	9.4486227	9.9821462	9.4664765	10.5335235	41
20	9.4490540	9.9821092	9.4669448	10.5330552	40
21	9.4494849	9.9820721	9.4674127	10.5325873	39
22	9.4499153	9.9820351	9.4678802	10.5321198	38
23	9.4503452	9.9819979	9.4683473	10.5316527	37
24	9.4507747	9.9819608	9.4688139	10.5311861	36
25	9.4512037	9.9819236	9.4692801	10.5307199	35
26	9.4516322	9.9818863	9.4697459	10.5302541	34
27	9.4520606	9.9818490	9.4702112	10.5297888	33
28	9.4524879	9.9818117	9.4706762	10.5293238	32
29	9.4529151	9.9817744	9.4711407	10.5288593	31
30	9.4533418	9.9817370	9.4716048	10.5283952	30
31	9.4537681	9.9816995	9.4720685	10.5279315	29
32	9.4541939	9.9816620	9.4725318	10.5274682	28
33	9.4546192	9.9816245	9.4729947	10.5270053	27
34	9.4550441	9.9815870	9.4734578	10.5265422	26
35	9.4554686	9.9815494	9.4739192	10.5260808	25
36	9.4558926	9.9815117	9.4743808	10.5256192	24
37	9.4563161	9.9814740	9.4748421	10.5251579	23
38	9.4567392	9.9814363	9.4753029	10.5246971	22
39	9.4571618	9.9813986	9.4757633	10.5242367	21
40	9.4575840	9.9813608	9.4762233	10.5237767	20
41	9.4580058	9.9813229	9.4766829	10.5233171	19
42	9.4584271	9.9812850	9.4771421	10.5228579	18
43	9.4588480	9.9812471	9.4776009	10.5223991	17
44	9.4592684	9.9812091	9.4780592	10.5219408	16
45	9.4596884	9.9811711	9.4785172	10.5214828	15
46	9.4601079	9.9811331	9.4789748	10.5210252	14
47	9.4605270	9.9810950	9.4794319	10.5205681	13
48	9.4609456	9.9810569	9.4798887	10.5201113	12
49	9.4613638	9.9810187	9.4803451	10.5196549	11
50	9.4617816	9.9809805	9.4808011	10.5191989	10
51	9.4621989	9.9809423	9.4812566	10.5187434	9
52	9.4626158	9.9809040	9.4817118	10.5182882	8
53	9.4630323	9.9808657	9.4821666	10.5178334	7
54	9.4634483	9.9808273	9.4826210	10.5173790	6
55	9.4638639	9.9807889	9.4830750	10.5169250	5
56	9.4642790	9.9807505	9.4835286	10.5164714	4
57	9.4646938	9.9807120	9.4839818	10.5160182	3
58	9.4651081	9.9806735	9.4844346	10.5155654	2
59	9.4655219	9.9806349	9.4848870	10.5151130	1
60	9.4659353	9.9805963	9.4853390	10.5146610	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

73 Degrees.

Min.	17 Degrees.				
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.4659353	9.9805963	9.4853390	10.5146610	60
1	9.4663483	9.9805577	9.4857907	10.5142093	59
2	9.4667609	9.9805190	9.4862419	10.5137581	58
3	9.4671730	9.9804803	9.4866928	10.5133072	57
4	9.4675848	9.9804415	9.4871433	10.5128567	56
5	9.4679960	9.9804027	9.4875933	10.5124067	55
6	9.4684069	9.9803639	9.4880430	10.5119570	54
7	9.4688173	9.9803250	9.4884924	10.5115076	53
8	9.4692273	9.9802860	9.4889413	10.5110587	52
9	9.4696369	9.9802471	9.4893908	10.5106102	51
10	9.4700461	9.9802081	9.4898380	10.5101620	50
11	9.4704548	9.9801690	9.4902858	10.5097142	49
12	9.4708631	9.9801299	9.4907332	10.5092668	48
13	9.4712710	9.9800908	9.4911802	10.5088198	47
14	9.4716785	9.9800516	9.4916269	10.5083731	46
15	9.4720856	9.9800124	9.4920731	10.5079269	45
16	9.4724922	9.9799732	9.4925190	10.5074810	44
17	9.4728985	9.9799339	9.4929646	10.5070354	43
18	9.4733043	9.9798946	9.4934097	10.5065903	42
19	9.4737097	9.9798552	9.4938545	10.5061455	41
20	9.4741146	9.9798158	9.4942988	10.5057012	40
21	9.4745192	9.9797764	9.4947429	10.5052571	39
22	9.4749234	9.9797369	9.4951865	10.5048131	38
23	9.4753271	9.9796973	9.4956298	10.5043702	37
24	9.4757304	9.9796578	9.4960727	10.5039273	36
25	9.4761334	9.9796182	9.4965152	10.5034848	35
26	9.4765359	9.9795785	9.4969574	10.5030426	34
27	9.4769380	9.9795388	9.4973991	10.5026009	33
28	9.4773396	9.9794991	9.4978406	10.5021594	32
29	9.4777409	9.9794593	9.4982816	10.5017184	31
30	9.4781418	9.9794195	9.4987223	10.5012777	30
31	9.4785423	9.9793796	9.4991626	10.5008374	29
32	9.4789423	9.9793398	9.4996026	10.5003974	28
33	9.4793420	9.9792998	9.5000422	10.4999578	27
34	9.4797412	9.9792599	9.5004814	10.4995186	26
35	9.4801401	9.9792198	9.5009207	10.4990797	25
36	9.4805385	9.9791798	9.5013588	10.4986412	24
37	9.4809366	9.9791397	9.5017969	10.4982031	23
38	9.4813342	9.9790996	9.5022347	10.4977653	22
39	9.4817315	9.9790594	9.5026721	10.4973279	21
40	9.4821283	9.9790192	9.5031092	10.4968908	20
41	9.4825248	9.9789789	9.5035459	10.4964541	19
42	9.4829208	9.9789386	9.5039822	10.4960178	18
43	9.4833165	9.9788983	9.5044182	10.4955818	17
44	9.4837117	9.9788579	9.5048538	10.4951462	16
45	9.4841066	9.9788175	9.5052891	10.4947109	15
46	9.4845010	9.9787770	9.5057240	10.4942760	14
47	9.4848951	9.9787365	9.5061586	10.4938414	13
48	9.4852888	9.9786960	9.5065928	10.4934072	12
49	9.4856820	9.9786554	9.5070267	10.4929733	11
50	9.4860749	9.9786148	9.5074602	10.4925398	10
51	9.4864674	9.9785741	9.5078933	10.4921067	9
52	9.4868595	9.9785334	9.5083261	10.4916739	8
53	9.4872512	9.9784927	9.5087586	10.4912414	7
54	9.4876426	9.9784519	9.5091907	10.4908093	6
55	9.4880335	9.9784111	9.5096224	10.4903776	5
56	9.4884240	9.9783702	9.5100539	10.4899461	4
57	9.4888142	9.9783293	9.5104849	10.4895151	3
58	9.4892040	9.9782883	9.5109156	10.4890844	2
59	9.4895934	9.9782474	9.5113460	10.4886540	1
60	9.4899824	9.9782063	9.5117760	10.4882240	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

72 Degrees.

SINES.

Min.	18 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.4899824	9.9782062	9.5117760	10.4882240	60
1	9.4903710	9.9781653	9.5122057	10.4877943	59
2	9.4907592	9.9781241	9.5126351	10.4873649	58
3	9.4911471	9.9780830	9.5130644	10.4869359	57
4	9.4915345	9.9780418	9.5134927	10.4865073	56
5	9.4919216	9.9780006	9.5139210	10.4860790	55
6	9.4923083	9.9779593	9.5143490	10.4856510	54
7	9.4926946	9.9779180	9.5147766	10.4852234	53
8	9.4930806	9.9778766	9.5152039	10.4847961	52
9	9.4934661	9.9778353	9.5156309	10.4843691	51
10	9.4938513	9.9777938	9.5160575	10.4839425	50
11	9.4942361	9.9777523	9.5164838	10.4835162	49
12	9.4946205	9.9777108	9.5169097	10.4830903	48
13	9.4950046	9.9776693	9.5173353	10.4826647	47
14	9.4953883	9.9776277	9.5177606	10.4822394	46
15	9.4957716	9.9775860	9.5181855	10.4818145	45
16	9.4961545	9.9775444	9.5186101	10.4813899	44
17	9.4965370	9.9775026	9.5190344	10.4809656	43
18	9.4969192	9.9774609	9.5194583	10.4805417	42
19	9.4973010	9.9774191	9.5198819	10.4801181	41
20	9.4976824	9.9773772	9.5203052	10.4796948	40
21	9.4980635	9.9773354	9.5207282	10.4792718	39
22	9.4984442	9.9772934	9.5211508	10.4788492	38
23	9.4988245	9.9772515	9.5215730	10.4784270	37
24	9.4992045	9.9772095	9.5219950	10.4780050	36
25	9.4995840	9.9771674	9.5224166	10.4775834	35
26	9.4999633	9.9771253	9.5228379	10.4771621	34
27	9.5003421	9.9770832	9.5232589	10.4767411	33
28	9.5007206	9.9770410	9.5236795	10.4763205	32
29	9.5010987	9.9769988	9.5240999	10.4759001	31
30	9.5014764	9.9769566	9.5245199	10.4754801	30
31	9.5018538	9.9769143	9.5249395	10.4750605	29
32	9.5022308	9.9768720	9.5253589	10.4746411	28
33	9.5026075	9.9768296	9.5257779	10.4742221	27
34	9.5029838	9.9767872	9.5261966	10.4738034	26
35	9.5033597	9.9767447	9.5266150	10.4733850	25
36	9.5037353	9.9767022	9.5270331	10.4729669	24
37	9.5041105	9.9766597	9.5274508	10.4725492	23
38	9.5044853	9.9766171	9.5278682	10.4721318	22
39	9.5048598	9.9765745	9.5282853	10.4717147	21
40	9.5052339	9.9765318	9.5287021	10.4712979	20
41	9.5056077	9.9764891	9.5291186	10.4708814	19
42	9.5059811	9.9764464	9.5295347	10.4704653	18
43	9.5063542	9.9764036	9.5299505	10.4700495	17
44	9.5067269	9.9763608	9.5303661	10.4696339	16
45	9.5070992	9.9763179	9.5307813	10.4692187	15
46	9.5074712	9.9762750	9.5311961	10.4688039	14
47	9.5078428	9.9762321	9.5316107	10.4683893	13
48	9.5082141	9.9761891	9.5320250	10.4679750	12
49	9.5085850	9.9761461	9.5324389	10.4675611	11
50	9.5089556	9.9761030	9.5328526	10.4671474	10
51	9.5093258	9.9760599	9.5332659	10.4667341	9
52	9.5096956	9.9760167	9.5336789	10.4663211	8
53	9.5100651	9.9759736	9.5340916	10.4659084	7
54	9.5104343	9.9759303	9.5345040	10.4654960	6
55	9.5108031	9.9758870	9.5349161	10.4650839	5
56	9.5111716	9.9758437	9.5353278	10.4646722	4
57	9.5115397	9.9758004	9.5357393	10.4642607	3
58	9.5119074	9.9757570	9.5361505	10.4638495	2
59	9.5122749	9.9757135	9.5365613	10.4634387	1
60	9.5126419	9.9756701	9.5369719	10.4630281	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

71 Degrees.

Min.	19 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.5126419	9.9756701	9.5369719	10.4630281	60
1	9.5130086	9.9756265	9.5373821	10.4626179	59
2	9.5133750	9.9755830	9.5377920	10.4622080	58
3	9.5137410	9.9755394	9.5382017	10.4617983	57
4	9.5141067	9.9754957	9.5386110	10.4613890	56
5	9.5144721	9.9754521	9.5390200	10.4609800	55
6	9.5148371	9.9754083	9.5394287	10.4605713	54
7	9.5152017	9.9753646	9.5398371	10.4601629	53
8	9.5155660	9.9753208	9.5402453	10.4597547	52
9	9.5159300	9.9752769	9.5406531	10.4593469	51
10	9.5162936	9.9752330	9.5410606	10.4589394	50
11	9.5166569	9.9751891	9.5414678	10.4585322	49
12	9.5170198	9.9751451	9.5418747	10.4581253	48
13	9.5173824	9.9751011	9.5422813	10.4577187	47
14	9.5177447	9.9750570	9.5426877	10.4573123	46
15	9.5181066	9.9750129	9.5430937	10.4569063	45
16	9.5184682	9.9749688	9.5434994	10.4565006	44
17	9.5188295	9.9749246	9.5439048	10.4560952	43
18	9.5191904	9.9748804	9.5443100	10.4556900	42
19	9.5195510	9.9748361	9.5447148	10.4552852	41
20	9.5199112	9.9747918	9.5451193	10.4548807	40
21	9.5202711	9.9747475	9.5455236	10.4544764	39
22	9.5206307	9.9747031	9.5459276	10.4540724	38
23	9.5209899	9.9746587	9.5463312	10.4536688	37
24	9.5213488	9.9746142	9.5467346	10.4532654	36
25	9.5217074	9.9745697	9.5471377	10.4528623	35
26	9.5220656	9.9745252	9.5475405	10.4524595	34
27	9.5224235	9.9744806	9.5479430	10.4520570	33
28	9.5227811	9.9744359	9.5483452	10.4516548	32
29	9.5231383	9.9743913	9.5487471	10.4512529	31
30	9.5234953	9.9743466	9.5491487	10.4508513	30
31	9.5238518	9.9743018	9.5495500	10.4504500	29
32	9.5242081	9.9742570	9.5499511	10.4500489	28
33	9.5245640	9.9742122	9.5503519	10.4496481	27
34	9.5249196	9.9741673	9.5507523	10.4492477	26
35	9.5252749	9.9741224	9.5511525	10.4488475	25
36	9.5256298	9.9740774	9.5515524	10.4484476	24
37	9.5259844	9.9740324	9.5519521	10.4480479	23
38	9.5263387	9.9739873	9.5523514	10.4476486	22
39	9.5266927	9.9739422	9.5527504	10.4472496	21
40	9.5270463	9.9738971	9.5531492	10.4468508	20
41	9.5273997	9.9738519	9.5535477	10.4464523	19
42	9.5277526	9.9738067	9.5539459	10.4460541	18
43	9.5281053	9.9737615	9.5543438	10.4456562	17
44	9.5284577	9.9737162	9.5547415	10.4452585	16
45	9.5288097	9.9736709	9.5551388	10.4448612	15
46	9.5291614	9.9736255	9.5555359	10.4444641	14
47	9.5295128	9.9735801	9.5559327	10.4440673	13
48	9.5298638	9.9735346	9.5563292	10.4436708	12
49	9.5302146	9.9734891	9.5567255	10.4432745	11
50	9.5305650	9.9734435	9.5571214	10.4428786	10
51	9.5309151	9.9733980	9.5575171	10.4424829	9
52	9.5312649	9.9733523	9.5579125	10.4420875	8
53	9.5316143	9.9733067	9.5583077	10.4416923	7
54	9.5319635	9.9732610	9.5587025	10.4412975	6
55	9.5323123	9.9732152	9.5590971	10.4409029	5
56	9.5326608	9.9731694	9.5594914	10.4405086	4
57	9.5330090	9.9731236	9.5598854	10.4401146	3
58	9.5333569	9.9730777	9.5602792	10.4397208	2
59	9.5337044	9.9730318	9.5606727	10.4393273	1
60	9.5340517	9.9729858	9.5610659	10.4389341	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

70 Degrees.

SINES.

Min.	20 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.5340517	9.9729858	9.5610659	10.4389341	60
1	9.5343986	9.9729398	9.5614588	10.4385412	59
2	9.5347452	9.9728938	9.5618515	10.4381485	58
3	9.5350915	9.9728477	9.5622439	10.4377561	57
4	9.5354375	9.9728016	9.5626360	10.4373640	56
5	9.5357832	9.9727554	9.5630278	10.4369722	55
6	9.5361286	9.9727092	9.5634194	10.4365806	54
7	9.5364737	9.9726629	9.5638107	10.4361893	53
8	9.5368184	9.9726166	9.5642018	10.4357982	52
9	9.5371629	9.9725703	9.5645925	10.4354075	51
10	9.5375070	9.9725239	9.5649831	10.4350169	50
11	9.5378508	9.9724775	9.5653733	10.4346267	49
12	9.5381943	9.9724310	9.5657633	10.4342367	48
13	9.5385375	9.9723845	9.5661530	10.4338470	47
14	9.5388804	9.9723380	9.5665424	10.4334576	46
15	9.5392230	9.9722914	9.5669316	10.4330684	45
16	9.5395653	9.9722448	9.5673205	10.4326795	44
17	9.5399073	9.9721981	9.5677091	10.4322909	43
18	9.5402489	9.9721514	9.5680975	10.4319025	42
19	9.5405903	9.9721047	9.5684856	10.4315144	41
20	9.5409314	9.9720579	9.5688735	10.4311265	40
21	9.5412721	9.9720110	9.5692611	10.4307389	39
22	9.5416126	9.9719642	9.5696484	10.4303516	38
23	9.5419527	9.9719174	9.5700355	10.4299645	37
24	9.5422926	9.9718703	9.5704223	10.4295777	36
25	9.5426321	9.9718233	9.5708088	10.4291912	35
26	9.5429713	9.9717762	9.5711951	10.4288049	34
27	9.5433103	9.9717291	9.5715811	10.4284189	33
28	9.5436489	9.9716820	9.5719669	10.4280331	32
29	9.5439873	9.9716348	9.5723524	10.4276476	31
30	9.5443253	9.9715876	9.5727377	10.4272623	30
31	9.5446630	9.9715404	9.5731227	10.4268773	29
32	9.5450005	9.9714931	9.5735074	10.4264926	28
33	9.5453376	9.9714457	9.5738919	10.4261081	27
34	9.5456745	9.9713984	9.5742761	10.4257239	26
35	9.5460110	9.9713509	9.5746601	10.4253399	25
36	9.5463472	9.9713035	9.5750438	10.4249562	24
37	9.5466832	9.9712560	9.5754272	10.4245728	23
38	9.5470189	9.9712084	9.5758104	10.4241896	22
39	9.5473542	9.9711608	9.5761934	10.4238066	21
40	9.5476893	9.9711132	9.5765761	10.4234239	20
41	9.5480240	9.9710655	9.5769585	10.4230415	19
42	9.5483585	9.9710178	9.5773407	10.4226593	18
43	9.5486927	9.9709701	9.5777226	10.4222774	17
44	9.5490266	9.9709223	9.5781043	10.4218957	16
45	9.5493602	9.9708744	9.5784858	10.4215142	15
46	9.5496935	9.9708265	9.5788669	10.4211331	14
47	9.5500265	9.9707786	9.5792479	10.4207521	13
48	9.5503592	9.9707306	9.5796286	10.4203714	12
49	9.5506916	9.9706826	9.5800090	10.4199910	11
50	9.5510237	9.9706346	9.5803892	10.4196108	10
51	9.5513556	9.9705865	9.5807691	10.4192309	9
52	9.5516871	9.9705383	9.5811488	10.4188512	8
53	9.5520184	9.9704902	9.5815282	10.4184718	7
54	9.5523494	9.9704419	9.5819074	10.4180926	6
55	9.5526801	9.9703937	9.5822864	10.4177136	5
56	9.5530105	9.9703454	9.5826651	10.4173349	4
57	9.5533406	9.9702970	9.5830435	10.4169565	3
58	9.5536704	9.9702486	9.5834217	10.4165783	2
59	9.5539999	9.9702002	9.5837997	10.4162003	1
60	9.5543292	9.9701517	9.5841774	10.4158226	0
	Cofine.	Sine.	Cotangent.	Tang.	

69 Degrees.

Min.	21 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.5543292	9.9701517	9.5841774	10.4158226	60
1	9.5546581	9.9701032	9.5845549	10.4154451	59
2	9.5549868	9.9700547	9.5849321	10.4150679	58
3	9.5553152	9.9700061	9.5853091	10.4146909	57
4	9.5556433	9.9699574	9.5856859	10.4143141	56
5	9.5559711	9.9699087	9.5860624	10.4139376	55
6	9.5562987	9.9698600	9.5864386	10.4135614	54
7	9.5566259	9.9698112	9.5868147	10.4131853	53
8	9.5569529	9.9697624	9.5871904	10.4128096	52
9	9.5572796	9.9697136	9.5875660	10.4124340	51
10	9.5576060	9.9696647	9.5879413	10.4120587	50
11	9.5579321	9.9696158	9.5883163	10.4116837	49
12	9.5582579	9.9695668	9.5886912	10.4113088	48
13	9.5585835	9.9695177	9.5890657	10.4109343	47
14	9.5589088	9.9694687	9.5894401	10.4105599	46
15	9.5592338	9.9694196	9.5898142	10.4101858	45
16	9.5595585	9.9693704	9.5901881	10.4098119	44
17	9.5598829	9.9693212	9.5905617	10.4094383	43
18	9.5602071	9.9692720	9.5909351	10.4090649	42
19	9.5605310	9.9692227	9.5913082	10.4086918	41
20	9.5608546	9.9691734	9.5916812	10.4083188	40
21	9.5611779	9.9691241	9.5920539	10.4079461	39
22	9.5615010	9.9690746	9.5924263	10.4075737	38
23	9.5618237	9.9690252	9.5927985	10.4072015	37
24	9.5621462	9.9689757	9.5931705	10.4068295	36
25	9.5624685	9.9689262	9.5935423	10.4064577	35
26	9.5627904	9.9688766	9.5939138	10.4060862	34
27	9.5631121	9.9688270	9.5942851	10.4057149	33
28	9.5634335	9.9687773	9.5946561	10.4053439	32
29	9.5637546	9.9687276	9.5950269	10.4049731	31
30	9.5640754	9.9686779	9.5953975	10.4046025	30
31	9.5643960	9.9686281	9.5957679	10.4042321	29
32	9.5647163	9.9685783	9.5961380	10.4038620	28
33	9.5650363	9.9685284	9.5965079	10.4034921	27
34	9.5653561	9.9684785	9.5968776	10.4031224	26
35	9.5656756	9.9684286	9.5972470	10.4027530	25
36	9.5659948	9.9683786	9.5976162	10.4023838	24
37	9.5663137	9.9683285	9.5979852	10.4020148	23
38	9.5666324	9.9682784	9.5983540	10.4016460	22
39	9.5669508	9.9682283	9.5987225	10.4012775	21
40	9.5672689	9.9681781	9.5990908	10.4009092	20
41	9.5675868	9.9681279	9.5994588	10.4005412	19
42	9.5679044	9.9680777	9.5998267	10.4001733	18
43	9.5682217	9.9680274	9.6001943	10.3998057	17
44	9.5685387	9.9679771	9.6005617	10.3994383	16
45	9.5688555	9.9679267	9.6009289	10.3990711	15
46	9.5691721	9.9678763	9.6012958	10.3987042	14
47	9.5694883	9.9678258	9.6016625	10.3983375	13
48	9.5698043	9.9677753	9.6020290	10.3979710	12
49	9.5701200	9.9677247	9.6023953	10.3976047	11
50	9.5704355	9.9676741	9.6027613	10.3972387	10
51	9.5707506	9.9676235	9.6031271	10.3968729	9
52	9.5710656	9.9675728	9.6034927	10.3965073	8
53	9.5713802	9.9675221	9.6038581	10.3961419	7
54	9.5716946	9.9674713	9.6042233	10.3957767	6
55	9.5720087	9.9674205	9.6045882	10.3954118	5
56	9.5723226	9.9673697	9.6049529	10.3950471	4
57	9.5726362	9.9673188	9.6053174	10.3946826	3
58	9.5729495	9.9672679	9.6056817	10.3943183	2
59	9.5732626	9.9672169	9.6060457	10.3939543	1
60	9.5735754	9.9671659	9.6064096	10.3935904	0
	Cofine.	Sine.	Cotangent.	Tang.	

68 Degrees.

SINES.

22 Degrees.					
Min.	Sine.	Cofine.	Tang.	Cotangent.	Min.
0	9.5735754	9.9671659	9.6064096	10.3935904	60
1	9.5738880	9.9671148	9.6067732	10.3932268	59
2	9.5742003	9.9670637	9.6071366	10.3928634	58
3	9.5745123	9.9670125	9.6074997	10.3925003	57
4	9.5748240	9.9669614	9.6078627	10.3921373	56
5	9.5751356	9.9669101	9.6082254	10.3917746	55
6	9.5754468	9.9668588	9.6085880	10.3914120	54
7	9.5757578	9.9668075	9.6089503	10.3910497	53
8	9.5760685	9.9667562	9.6093124	10.3906876	52
9	9.5763790	9.9667048	9.6096742	10.3903258	51
10	9.5766892	9.9666533	9.6100359	10.3899641	50
11	9.5769991	9.9666018	9.6103973	10.3896027	49
12	9.5773088	9.9665503	9.6107586	10.3892414	48
13	9.5776183	9.9664986	9.6111196	10.3888804	47
14	9.5779275	9.9664471	9.6114804	10.3885196	46
15	9.5782364	9.9663954	9.6118409	10.3881591	45
16	9.5785450	9.9663437	9.6122013	10.3877937	44
17	9.5788535	9.9662920	9.6125615	10.3874385	43
18	9.5791616	9.9662402	9.6129214	10.3870786	42
19	9.5794695	9.9661884	9.6132812	10.3867188	41
20	9.5797772	9.9661365	9.6136407	10.3863593	40
21	9.5800845	9.9660846	9.6140000	10.3860000	39
22	9.5803917	9.9660326	9.6143591	10.3856409	38
23	9.5806986	9.9659806	9.6147180	10.3852820	37
24	9.5810052	9.9659285	9.6150766	10.3849234	36
25	9.5813116	9.9658764	9.6154351	10.3845649	35
26	9.5816177	9.9658243	9.6157934	10.3842066	34
27	9.5819236	9.9657721	9.6161514	10.3838486	33
28	9.5822292	9.9657199	9.6165093	10.3834907	32
29	9.5825345	9.9656677	9.6168669	10.3831331	31
30	9.5828397	9.9656153	9.6172243	10.3827757	30
31	9.5831445	9.9655630	9.6175815	10.3824185	29
32	9.5834491	9.9655106	9.6179385	10.3820615	28
33	9.5837535	9.9654582	9.6182953	10.3817047	27
34	9.5840576	9.9654057	9.6186519	10.3813481	26
35	9.5843615	9.9653532	9.6190083	10.3809917	25
36	9.5846651	9.9653006	9.6193645	10.3806355	24
37	9.5849685	9.9652480	9.6197205	10.3802795	23
38	9.5852716	9.9651953	9.6200762	10.3799238	22
39	9.5855745	9.9651426	9.6204318	10.3795682	21
40	9.5858771	9.9650899	9.6207872	10.3792128	20
41	9.5861795	9.9650371	9.6211423	10.3788577	19
42	9.5864816	9.9649843	9.6214977	10.3785026	18
43	9.5867835	9.9649314	9.6218520	10.3781480	17
44	9.5870851	9.9648785	9.6222066	10.3777934	16
45	9.5873865	9.9648256	9.6225609	10.3774391	15
46	9.5876876	9.9647726	9.6229150	10.3770850	14
47	9.5879885	9.9647195	9.6232690	10.3767310	13
48	9.5882892	9.9646665	9.6236227	10.3763773	12
49	9.5885896	9.9646133	9.6239763	10.3760237	11
50	9.5888897	9.9645602	9.6243296	10.3756704	10
51	9.5891897	9.9645069	9.6246827	10.3753173	9
52	9.5894893	9.9644537	9.6250356	10.3749644	8
53	9.5897888	9.9644004	9.6253884	10.3746116	7
54	9.5900880	9.9643470	9.6257409	10.3742591	6
55	9.5903869	9.9642937	9.6260932	10.3739068	5
56	9.5906856	9.9642402	9.6264454	10.3735546	4
57	9.5909841	9.9641868	9.6267973	10.3732027	3
58	9.5912823	9.9641332	9.6271491	10.3728509	2
59	9.5915803	9.9640797	9.6275006	10.3724994	1
60	9.5918780	9.9640261	9.6278519	10.3721481	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

67 Degrees.

23 Degrees.					
Min.	Sine.	Cofine.	Tang.	Cotangent.	Min.
0	9.5918780	9.9640261	9.6278519	10.3721481	60
1	9.5921755	9.9639724	9.6282031	10.3717969	59
2	9.5924728	9.9639187	9.6285540	10.3714460	58
3	9.5927698	9.9638650	9.6289048	10.3710952	57
4	9.5930666	9.9638112	9.6292553	10.3707447	56
5	9.5933631	9.9637574	9.6296057	10.3703943	55
6	9.5936594	9.9637036	9.6299558	10.3700442	54
7	9.5939555	9.9636496	9.6303058	10.3696942	53
8	9.5942513	9.9635957	9.6306556	10.3693444	52
9	9.5945469	9.9635417	9.6310052	10.3689948	51
10	9.5948422	9.9634877	9.6313545	10.3686455	50
11	9.5951373	9.9634336	9.6317037	10.3682963	49
12	9.5954322	9.9633795	9.6320527	10.3679473	48
13	9.5957268	9.9633253	9.6324015	10.3675985	47
14	9.5960212	9.9632711	9.6327501	10.3672499	46
15	9.5963154	9.9632168	9.6330985	10.3669015	45
16	9.5966093	9.9631625	9.6334468	10.3665532	44
17	9.5969030	9.9631082	9.6337948	10.3662052	43
18	9.5971965	9.9630538	9.6341426	10.3658574	42
19	9.5974897	9.9629994	9.6344903	10.3655097	41
20	9.5977827	9.9629449	9.6348378	10.3651622	40
21	9.5980754	9.9628904	9.6351850	10.3648150	39
22	9.5983679	9.9628358	9.6355321	10.3644679	38
23	9.5986602	9.9627812	9.6358790	10.3641210	37
24	9.5989523	9.9627266	9.6362257	10.3637743	36
25	9.5992441	9.9626719	9.6365722	10.3634278	35
26	9.5995357	9.9626172	9.6369185	10.3630815	34
27	9.5998270	9.9625624	9.6372646	10.3627354	33
28	9.6001181	9.9625076	9.6376106	10.3623894	32
29	9.6004090	9.9624527	9.6379563	10.3620437	31
30	9.6006997	9.9623978	9.6383019	10.3616981	30
31	9.6009901	9.9623428	9.6386473	10.3613527	29
32	9.6012803	9.9622878	9.6389925	10.3610075	28
33	9.6015703	9.9622328	9.6393375	10.3606625	27
34	9.6018600	9.9621777	9.6396823	10.3603177	26
35	9.6021495	9.9621226	9.6400269	10.3599731	25
36	9.6024388	9.9620674	9.6403714	10.3596286	24
37	9.6027278	9.9620122	9.6407156	10.3592844	23
38	9.6030166	9.9619569	9.6410597	10.3589403	22
39	9.6033052	9.9619016	9.6414036	10.3585964	21
40	9.6035936	9.9618463	9.6417473	10.3582527	20
41	9.6038817	9.9617909	9.6420908	10.3579092	19
42	9.6041696	9.9617355	9.6424342	10.3575658	18
43	9.6044573	9.9616800	9.6427773	10.3572227	17
44	9.6047448	9.9616245	9.6431203	10.3568797	16
45	9.6050320	9.9615689	9.6434631	10.3565369	15
46	9.6053190	9.9615133	9.6438057	10.3561943	14
47	9.6056057	9.9614576	9.6441481	10.3558519	13
48	9.6058923	9.9614020	9.6444903	10.3555097	12
49	9.6061786	9.9613462	9.6448324	10.3551676	11
50	9.6064647	9.9612904	9.6451743	10.3548257	10
51	9.6067506	9.9612346	9.6455160	10.3544840	9
52	9.6070362	9.9611787	9.6458575	10.3541425	8
53	9.6073216	9.9611228	9.6461988	10.3538012	7
54	9.6076068	9.9610668	9.6465400	10.3534600	6
55	9.6078918	9.9610108	9.6468810	10.3531190	5
56	9.6081765	9.9609548	9.6472217	10.3527783	4
57	9.6084611	9.9608987	9.6475624	10.3524376	3
58	9.6087454	9.9608426	9.6479028	10.3520972	2
59	9.6090294	9.9607864	9.6482431	10.3517569	1
60	9.6093133	9.9607302	9.6485831	10.3514169	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

66 Degrees.

SINES.

		24 Degrees.				
Min.	Sine.	Cofine.	Tang.	Cotangent.		
0	9.6093133	9.9607302	9.6485831	10.3514169	60	
1	9.6095069	9.9606739	9.6489230	10.3510770	59	
2	9.6098803	9.9606176	9.6492628	10.3507372	58	
3	9.6101635	9.9605612	9.6496023	10.3503977	57	
4	9.6104465	9.9605048	9.6499417	10.3500583	56	
5	9.6107293	9.9604484	9.6502810	10.3497191	55	
6	9.6110118	9.9603919	9.6506199	10.3493801	54	
7	9.6112941	9.9603354	9.6509587	10.3490413	53	
8	9.6115762	9.9602788	9.6512974	10.3487026	52	
9	9.6118580	9.9602222	9.6516359	10.3483641	51	
10	9.6121397	9.9601655	9.6519742	10.3480258	50	
11	9.6124211	9.9601088	9.6523123	10.3476877	49	
12	9.6127023	9.9600520	9.6526503	10.3473497	48	
13	9.6129833	9.9599952	9.6529881	10.3470119	47	
14	9.6132641	9.9599384	9.6533257	10.3466743	46	
15	9.6135446	9.9598815	9.6536631	10.3463369	45	
16	9.6138250	9.9598246	9.6540004	10.3459996	44	
17	9.6141051	9.9597676	9.6543375	10.3456625	43	
18	9.6143850	9.9597106	9.6546744	10.3453256	42	
19	9.6146647	9.9596535	9.6550112	10.3449888	41	
20	9.6149441	9.9595964	9.6553477	10.3446523	40	
21	9.6152234	9.9595393	9.6556841	10.3443159	39	
22	9.6155024	9.9594821	9.6560204	10.3439796	38	
23	9.6157812	9.9594248	9.6563564	10.3436436	37	
24	9.6160599	9.9593675	9.6566923	10.3433077	36	
25	9.6163382	9.9593102	9.6570280	10.3429720	35	
26	9.6166164	9.9592528	9.6573636	10.3426364	34	
27	9.6168944	9.9591954	9.6576989	10.3423011	33	
28	9.6171721	9.9591380	9.6580341	10.3419659	32	
29	9.6174496	9.9590805	9.6583692	10.3416308	31	
30	9.6177270	9.9590229	9.6587041	10.3412959	30	
31	9.6180041	9.9589653	9.6590387	10.3409613	29	
32	9.6182809	9.9589077	9.6593733	10.3406267	28	
33	9.6185576	9.9588500	9.6597076	10.3402924	27	
34	9.6188341	9.9587923	9.6600418	10.3399582	26	
35	9.6191103	9.9587345	9.6603758	10.3396242	25	
36	9.6193864	9.9586767	9.6607097	10.3392903	24	
37	9.6196622	9.9586188	9.6610434	10.3389563	23	
38	9.6199378	9.9585609	9.6613769	10.3386231	22	
39	9.6202132	9.9585030	9.6617103	10.3382897	21	
40	9.6204884	9.9584450	9.6620434	10.3379566	20	
41	9.6207634	9.9583869	9.6623765	10.3376235	19	
42	9.6210382	9.9583288	9.6627093	10.3372907	18	
43	9.6213127	9.9582707	9.6630420	10.3369580	17	
44	9.6215871	9.9582125	9.6633745	10.3366255	16	
45	9.6218612	9.9581543	9.6637069	10.3362931	15	
46	9.6221351	9.9580961	9.6640391	10.3359609	14	
47	9.6224088	9.9580378	9.6643711	10.3356289	13	
48	9.6226824	9.9579794	9.6647030	10.3352970	12	
49	9.6229557	9.9579210	9.6650346	10.3349654	11	
50	9.6232287	9.9578626	9.6653662	10.3346338	10	
51	9.6235016	9.9578041	9.6656975	10.3343025	9	
52	9.6237743	9.9577456	9.6660288	10.3339712	8	
53	9.6240468	9.9576870	9.6663598	10.3336402	7	
54	9.6243190	9.9576284	9.6666907	10.3333093	6	
55	9.6245911	9.9575697	9.6670214	10.3329786	5	
56	9.6248629	9.9575110	9.6673519	10.3326481	4	
57	9.6251346	9.9574522	9.6676823	10.3323177	3	
58	9.6254060	9.9573934	9.6680126	10.3319874	2	
59	9.6256772	9.9573346	9.6683426	10.3316574	1	
60	9.6259483	9.9572757	9.6686725	10.3313275	0	
	Cofine.	Sine.	Cotangent.	Tang.	Min.	

65 Degrees.

		25 Degrees.				
Min.	Sine.	Cofine.	Tang.	Cotangent.		
0	9.6259483	9.9572757	9.6686725	10.3313275	60	
1	9.6262191	9.9572168	9.6690023	10.3309977	59	
2	9.6264897	9.9571578	9.6693319	10.3306681	58	
3	9.6267601	9.9570988	9.6696613	10.3303387	57	
4	9.6270303	9.9570397	9.6699906	10.3300094	56	
5	9.6273003	9.9569806	9.6703197	10.3296803	55	
6	9.6275701	9.9569215	9.6706486	10.3293514	54	
7	9.6278397	9.9568623	9.6709774	10.3290226	53	
8	9.6281090	9.9568030	9.6713060	10.3286940	52	
9	9.6283782	9.9567437	9.6716345	10.3283655	51	
10	9.6286472	9.9566844	9.6719628	10.3280372	50	
11	9.6289160	9.9566250	9.6722910	10.3277090	49	
12	9.6291845	9.9565656	9.6726190	10.3273810	48	
13	9.6294529	9.9565061	9.6729468	10.3270532	47	
14	9.6297211	9.9564466	9.6732745	10.3267255	46	
15	9.6299890	9.9563870	9.6736020	10.3263980	45	
16	9.6302568	9.9563274	9.6739294	10.3260706	44	
17	9.6305243	9.9562678	9.6742566	10.3257434	43	
18	9.6307917	9.9562081	9.6745836	10.3254164	42	
19	9.6310589	9.9561483	9.6749105	10.3250895	41	
20	9.6313258	9.9560886	9.6752372	10.3247628	40	
21	9.6315926	9.9560287	9.6755638	10.3244362	39	
22	9.6318591	9.9559689	9.6758903	10.3241097	38	
23	9.6321255	9.9559089	9.6762165	10.3237835	37	
24	9.6323916	9.9558490	9.6765426	10.3234574	36	
25	9.6326576	9.9557890	9.6768686	10.3231314	35	
26	9.6329233	9.9557289	9.6771944	10.3228056	34	
27	9.6331889	9.9556688	9.6775201	10.3224799	33	
28	9.6334542	9.9556087	9.6778456	10.3221544	32	
29	9.6337194	9.9555485	9.6781709	10.3218291	31	
30	9.6339844	9.9554882	9.6784961	10.3215039	30	
31	9.6342491	9.9554280	9.6788211	10.3211789	29	
32	9.6345137	9.9553676	9.6791460	10.3208540	28	
33	9.6347780	9.9553073	9.6794708	10.3205292	27	
34	9.6350422	9.9552469	9.6797953	10.3202047	26	
35	9.6353062	9.9551864	9.6801198	10.3198802	25	
36	9.6355699	9.9551259	9.6804440	10.3195560	24	
37	9.6358335	9.9550653	9.6807682	10.3192318	23	
38	9.6360969	9.9550047	9.6810921	10.3189079	22	
39	9.6363601	9.9549441	9.6814160	10.3185840	21	
40	9.6366231	9.9548834	9.6817396	10.3182604	20	
41	9.6368859	9.9548227	9.6820632	10.3179368	19	
42	9.6371484	9.9547619	9.6823865	10.3176135	18	
43	9.6374108	9.9547011	9.6827098	10.3172902	17	
44	9.6376731	9.9546402	9.6830328	10.3169672	16	
45	9.6379351	9.9545793	9.6833557	10.3166443	15	
46	9.6381969	9.9545184	9.6836785	10.3163215	14	
47	9.6384585	9.9544574	9.6840011	10.3159989	13	
48	9.6387199	9.9543963	9.6843236	10.3156764	12	
49	9.6389812	9.9543352	9.6846459	10.3153541	11	
50	9.6392422	9.9542741	9.6849681	10.3150319	10	
51	9.6395030	9.9542129	9.6852901	10.3147099	9	
52	9.6397637	9.9541517	9.6856120	10.3143880	8	
53	9.6400241	9.9540904	9.6859338	10.3140662	7	
54	9.6402844	9.9540291	9.6862553	10.3137447	6	
55	9.6405445	9.9539677	9.6865768	10.3134232	5	
56	9.6408044	9.9539063	9.6868981	10.3131019	4	
57	9.6410640	9.9538448	9.6872192	10.3127808	3	
58	9.6413235	9.9537833	9.6875402	10.3124598	2	
59	9.6415828	9.9537218	9.6878611	10.3121389	1	
60	9.6418420	9.9536602	9.6881818	10.3118182	0	
	Cofine.	Sine.	Cotangent.	Tang.	Min.	

64 Degrees.

SINES.

26 Degrees.				
Min.	Sine.	Cofine.	Tang.	Cotangent.
0	9.6418420	9.9536602	9.6881818	10.31118182
1	9.6421009	9.9535985	9.6885023	10.3114977
2	9.6423596	9.9535369	9.6888227	10.3111773
3	9.6426182	9.9534751	9.6891430	10.3108570
4	9.6428765	9.9534134	9.6894631	10.3105369
5	9.6431347	9.9533515	9.6897831	10.3102169
6	9.6433926	9.9532897	9.6901030	10.3098970
7	9.6436504	9.9532278	9.6904226	10.3095774
8	9.6439080	9.9531658	9.6907422	10.3092578
9	9.6441654	9.9531038	9.6910616	10.3089384
10	9.6444226	9.9530418	9.6913809	10.3086191
11	9.6446796	9.9529797	9.6917000	10.3083000
12	9.6449365	9.9529175	9.6920189	10.3079811
13	9.6451931	9.9528553	9.6923378	10.3076622
14	9.6454496	9.9527931	9.6926565	10.3073435
15	9.6457058	9.9527308	9.6929750	10.3070250
16	9.6459619	9.9526685	9.6932934	10.3067066
17	9.6462178	9.9526061	9.6936117	10.3063883
18	9.6464735	9.9525437	9.6939298	10.3060702
19	9.6467290	9.9524813	9.6942478	10.3057522
20	9.6469844	9.9524188	9.6945656	10.3054344
21	9.6472395	9.9523562	9.6948833	10.3051167
22	9.6474945	9.9522936	9.6952009	10.3047991
23	9.6477492	9.9522310	9.6955183	10.3044817
24	9.6480038	9.9521683	9.6958355	10.3041645
25	9.6482582	9.9521055	9.6961527	10.3038473
26	9.6485124	9.9520428	9.6964697	10.3035303
27	9.6487665	9.9519799	9.6967865	10.3032135
28	9.6490203	9.9519171	9.6971032	10.3028968
29	9.6492740	9.9518541	9.6974198	10.3025802
30	9.6495274	9.9517912	9.6977363	10.3022637
31	9.6497807	9.9517282	9.6980526	10.3019474
32	9.6500338	9.9516651	9.6983687	10.3016313
33	9.6502868	9.9516020	9.6986847	10.3013153
34	9.6505395	9.9515389	9.6990006	10.3009994
35	9.6507920	9.9514757	9.6993164	10.3006836
36	9.6510444	9.9514124	9.6996320	10.3003680
37	9.6512966	9.9513492	9.6999474	10.3000526
38	9.6515486	9.9512858	9.7002628	10.2997372
39	9.6518004	9.9512224	9.7005780	10.2994220
40	9.6520521	9.9511590	9.7008930	10.2991070
41	9.6523035	9.9510956	9.7012080	10.2987920
42	9.6525548	9.9510320	9.7015227	10.2984773
43	9.6528059	9.9509685	9.7018374	10.2981626
44	9.6530568	9.9509049	9.7021519	10.2978481
45	9.6533075	9.9508412	9.7024663	10.2975337
46	9.6535581	9.9507775	9.7027805	10.2972195
47	9.6538084	9.9507138	9.7030946	10.2969054
48	9.6540586	9.9506500	9.7034086	10.2965914
49	9.6543086	9.9505861	9.7037225	10.2962775
50	9.6545584	9.9505223	9.7040362	10.2959638
51	9.6548081	9.9504583	9.7043497	10.2956503
52	9.6550575	9.9503944	9.7046632	10.2953368
53	9.6553068	9.9503303	9.7049765	10.2950235
54	9.6555559	9.9502663	9.7052897	10.2947103
55	9.6558048	9.9502022	9.7056027	10.2943973
56	9.6560536	9.9501380	9.7059156	10.2940844
57	9.6563021	9.9500738	9.7062284	10.2937716
58	9.6565505	9.9500095	9.7065410	10.2934590
59	9.6567987	9.9499452	9.7068535	10.2931465
60	9.6570468	9.9498809	9.7071659	10.2928341
	Cofine.	Sine.	Cotangent.	Tang.

63 Degrees.

27 Degrees.				
Min.	Sine.	Cofine.	Tang.	Cotangent.
0	9.6570468	9.9498809	9.7071659	10.2928341
1	9.6572946	9.9498165	9.7074781	10.2925219
2	9.6575423	9.9497521	9.7077902	10.2922098
3	9.6577898	9.9496876	9.7081022	10.2918978
4	9.6580371	9.9496230	9.7084141	10.2915859
5	9.6582842	9.9495585	9.7087258	10.2912742
6	9.6585312	9.9494938	9.7090374	10.2909626
7	9.6587780	9.9494292	9.7093488	10.2906512
8	9.6590246	9.9493645	9.7096601	10.2903399
9	9.6592710	9.9492997	9.7099713	10.2900287
10	9.6595173	9.9492349	9.7102824	10.2897176
11	9.6597633	9.9491700	9.7105933	10.2894067
12	9.6600093	9.9491051	9.7109041	10.2890959
13	9.6602550	9.9490402	9.7112148	10.2887852
14	9.6605005	9.9489752	9.7115254	10.2884746
15	9.6607459	9.9489101	9.7118358	10.2881642
16	9.6609911	9.9488450	9.7121461	10.2878539
17	9.6612361	9.9487799	9.7124562	10.2875438
18	9.6614810	9.9487147	9.7127662	10.2872338
19	9.6617257	9.9486495	9.7130761	10.2869239
20	9.6619702	9.9485842	9.7133859	10.2866141
21	9.6622145	9.9485189	9.7136956	10.2863044
22	9.6624586	9.9484535	9.7140051	10.2859949
23	9.6627026	9.9483881	9.7143145	10.2856855
24	9.6629464	9.9483227	9.7146237	10.2853763
25	9.6631900	9.9482572	9.7149329	10.2850671
26	9.6634335	9.9481916	9.7152419	10.2847581
27	9.6636768	9.9481260	9.7155508	10.2844492
28	9.6639199	9.9480604	9.7158595	10.2841405
29	9.6641628	9.9479947	9.7161682	10.2838318
30	9.6644056	9.9479289	9.7164767	10.2835233
31	9.6646482	9.9478631	9.7167851	10.2832149
32	9.6648906	9.9477973	9.7170933	10.2829067
33	9.6651329	9.9477314	9.7174014	10.2825986
34	9.6653749	9.9476655	9.7177094	10.2822906
35	9.6656168	9.9475995	9.7180173	10.2819827
36	9.6658585	9.9475335	9.7183251	10.2816749
37	9.6661001	9.9474674	9.7186327	10.2813673
38	9.6663415	9.9474013	9.7189402	10.2810598
39	9.6665828	9.9473352	9.7192476	10.2807524
40	9.6668238	9.9472690	9.7195549	10.2804451
41	9.6670647	9.9472027	9.7198622	10.2801380
42	9.6673054	9.9471364	9.7201696	10.2798310
43	9.6675459	9.9470700	9.7204759	10.2795241
44	9.6677863	9.9470036	9.7207827	10.2792173
45	9.6680265	9.9469372	9.7210893	10.2789107
46	9.6682665	9.9468707	9.7213958	10.2786042
47	9.6685064	9.9468042	9.7217022	10.2782978
48	9.6687461	9.9467376	9.7220085	10.2779915
49	9.6689856	9.9466710	9.7223147	10.2776853
50	9.6692250	9.9466043	9.7226207	10.2773793
51	9.6694642	9.9465376	9.7229266	10.2770734
52	9.6697032	9.9464708	9.7232324	10.2767676
53	9.6699420	9.9464040	9.7235381	10.2764619
54	9.6701807	9.9463371	9.7238436	10.2761564
55	9.6704192	9.9462702	9.7241490	10.2758510
56	9.6706576	9.9462032	9.7244543	10.2755457
57	9.6708958	9.9461362	9.7247595	10.2752405
58	9.6711338	9.9460692	9.7250646	10.2749354
59	9.6713716	9.9460021	9.7253695	10.2746305
60	9.6716093	9.9459349	9.7256744	10.2743256
	Cofine.	Sine.	Cotangent.	Tang.

62 Degrees.

SINES.

Min.	28 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.6716093	9.9459349	9.7256744	10.2743256	60
1	9.6718468	9.9458677	9.7259791	10.2740209	59
2	9.6720841	9.9458005	9.7262837	10.2737163	58
3	9.6723213	9.9457332	9.7265881	10.2734119	57
4	9.6725583	9.9456659	9.7268925	10.2731075	56
5	9.6727952	9.9455985	9.7271967	10.2728033	55
6	9.6730319	9.9455310	9.7275008	10.2724992	54
7	9.6732684	9.9454636	9.7278048	10.2721952	53
8	9.6735047	9.9453960	9.7281087	10.2718913	52
9	9.6737409	9.9453285	9.7284124	10.2715876	51
10	9.6739769	9.9452609	9.7287161	10.2712839	50
11	9.6742128	9.9451932	9.7290196	10.2709804	49
12	9.6744485	9.9451255	9.7293230	10.2706770	48
13	9.6746840	9.9450577	9.7296263	10.2703737	47
14	9.6749194	9.9449899	9.7299295	10.2700705	46
15	9.6751546	9.9449220	9.7302325	10.2697675	45
16	9.6753896	9.9448541	9.7305354	10.2694646	44
17	9.6756245	9.9447862	9.7308383	10.2691617	43
18	9.6758592	9.9447181	9.7311410	10.2688590	42
19	9.6760937	9.9446502	9.7314436	10.2685564	41
20	9.6763281	9.9445821	9.7317460	10.2682540	40
21	9.6765623	9.9445139	9.7320484	10.2679516	39
22	9.6767963	9.9444457	9.7323506	10.2676494	38
23	9.6770302	9.9443775	9.7326527	10.2673473	37
24	9.6772640	9.9443092	9.7329547	10.2670453	36
25	9.6774975	9.9442409	9.7332566	10.2667434	35
26	9.6777309	9.9441725	9.7335584	10.2664416	34
27	9.6779642	9.9441041	9.7338601	10.2661399	33
28	9.6781972	9.9440356	9.7341616	10.2658384	32
29	9.6784301	9.9439671	9.7344631	10.2655369	31
30	9.6786629	9.9438985	9.7347644	10.2652356	30
31	9.6788955	9.9438299	9.7350656	10.2649344	29
32	9.6791279	9.9437612	9.7353667	10.2646333	28
33	9.6793602	9.9436925	9.7356677	10.2643323	27
34	9.6795923	9.9436238	9.7359685	10.2640315	26
35	9.6798243	9.9435549	9.7362693	10.2637307	25
36	9.6800567	9.9434861	9.7365709	10.2634301	24
37	9.6802877	9.9434172	9.7368705	10.2631295	23
38	9.6805191	9.9433482	9.7371709	10.2628291	22
39	9.6807504	9.9432792	9.7374712	10.2625288	21
40	9.6809816	9.9432102	9.7377714	10.2622286	20
41	9.6812126	9.9431411	9.7380715	10.2619285	19
42	9.6814434	9.9430720	9.7383714	10.2616286	18
43	9.6816741	9.9430028	9.7386713	10.2613287	17
44	9.6819046	9.9429335	9.7389710	10.2610290	16
45	9.6821349	9.9428643	9.7392707	10.2607293	15
46	9.6823651	9.9427949	9.7395702	10.2604298	14
47	9.6825952	9.9427255	9.7398696	10.2601304	13
48	9.6828250	9.9426561	9.7401689	10.2598311	12
49	9.6830548	9.9425866	9.7404681	10.2595319	11
50	9.6832843	9.9425171	9.7407672	10.2592328	10
51	9.6835137	9.9424476	9.7410662	10.2589338	9
52	9.6837430	9.9423779	9.7413650	10.2586350	8
53	9.6839720	9.9423083	9.7416638	10.2583362	7
54	9.6842010	9.9422386	9.7419624	10.2580376	6
55	9.6844297	9.9421688	9.7422609	10.2577391	5
56	9.6846583	9.9420990	9.7425594	10.2574406	4
57	9.6848868	9.9420291	9.7428577	10.2571423	3
58	9.6851151	9.9419592	9.7431559	10.2568441	2
59	9.6853432	9.9418893	9.7434540	10.2565460	1
60	9.6855712	9.9418193	9.7437520	10.2562480	0
	Cofine.	Sine.	Cotangent.	Tang.	

61 Degrees.

Min.	29 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.6855712	9.9418193	9.7437520	10.2562480	60
1	9.6857991	9.9417492	9.7440499	10.2559501	59
2	9.6860267	9.9416791	9.7443476	10.2556524	58
3	9.6862542	9.9416090	9.7446453	10.2553547	57
4	9.6864816	9.9415388	9.7449428	10.2550572	56
5	9.6867088	9.9414685	9.7452403	10.2547597	55
6	9.6869359	9.9413982	9.7455376	10.2544624	54
7	9.6871628	9.9413279	9.7458349	10.2541651	53
8	9.6873895	9.9412575	9.7461320	10.2538670	52
9	9.6876161	9.9411871	9.7464290	10.2535690	51
10	9.6878425	9.9411166	9.7467259	10.2532711	50
11	9.6880688	9.9410461	9.7470227	10.2529773	49
12	9.6882949	9.9409755	9.7473194	10.2526806	48
13	9.6885209	9.9409048	9.7476160	10.2523840	47
14	9.6887467	9.9408342	9.7479125	10.2520875	46
15	9.6889723	9.9407634	9.7482089	10.2517911	45
16	9.6891978	9.9406927	9.7485052	10.2514948	44
17	9.6894232	9.9406219	9.7488013	10.2511987	43
18	9.6896484	9.9405510	9.7490974	10.2509026	42
19	9.6898734	9.9404801	9.7493934	10.2506066	41
20	9.6900983	9.9404091	9.7496892	10.2503108	40
21	9.6903231	9.9403381	9.7499850	10.2500150	39
22	9.6905476	9.9402670	9.7502806	10.2497194	38
23	9.6907721	9.9401959	9.7505762	10.2494238	37
24	9.6909964	9.9401248	9.7508716	10.2491284	36
25	9.6912205	9.9400535	9.7511669	10.2488331	35
26	9.6914445	9.9399823	9.7514622	10.2485378	34
27	9.6916683	9.9399110	9.7517573	10.2482427	33
28	9.6918919	9.9398396	9.7520523	10.2479477	32
29	9.6921155	9.9397682	9.7523472	10.2476528	31
30	9.6923388	9.9396968	9.7526420	10.2473580	30
31	9.6925620	9.9396253	9.7529368	10.2470632	29
32	9.6927851	9.9395537	9.7532314	10.2467686	28
33	9.6930080	9.9394821	9.7535259	10.2464741	27
34	9.6932308	9.9394105	9.7538203	10.2461797	26
35	9.6934534	9.9393388	9.7541146	10.2458854	25
36	9.6936758	9.9392671	9.7544088	10.2455912	24
37	9.6938981	9.9391953	9.7547029	10.2452971	23
38	9.6941203	9.9391234	9.7549969	10.2450031	22
39	9.6943423	9.9390515	9.7552908	10.2447092	21
40	9.6945642	9.9389796	9.7555846	10.2444154	20
41	9.6947859	9.9389076	9.7558783	10.2441217	19
42	9.6950074	9.9388356	9.7561718	10.2438282	18
43	9.6952288	9.9387635	9.7564653	10.2435347	17
44	9.6954501	9.9386914	9.7567587	10.2432413	16
45	9.6956712	9.9386192	9.7570520	10.2429480	15
46	9.6958922	9.9385470	9.7573452	10.2426548	14
47	9.6961130	9.9384747	9.7576383	10.2423617	13
48	9.6963336	9.9384024	9.7579313	10.2420687	12
49	9.6965541	9.9383300	9.7582242	10.2417758	11
50	9.6967745	9.9382576	9.7585170	10.2414830	10
51	9.6969947	9.9381851	9.7588096	10.2411904	9
52	9.6972148	9.9381126	9.7591022	10.2408978	8
53	9.6974347	9.9380400	9.7593947	10.2406053	7
54	9.6976545	9.9379674	9.7596871	10.2403129	6
55	9.6978741	9.9378947	9.7599794	10.2400206	5
56	9.6980936	9.9378220	9.7602716	10.2397284	4
57	9.6983129	9.9377492	9.7605637	10.2394363	3
58	9.6985321	9.9376764	9.7608557	10.2391443	2
59	9.6987511	9.9376035	9.7611476	10.2388524	1
60	9.6989700	9.9375306	9.7614394	10.2385606	0
	Cofine.	Sine.	Cotangent.	Tang.	

60 Degrees.

SINES.

		30 Degrees.				
Min.	Sine.	Cofine.	Tang.	Cotangent.		Min.
0	9.6989700	9.9375306	9.7614394	10.2385606	60	0
1	9.6991887	9.9374577	9.7617311	10.2382689	59	1
2	9.6994073	9.9373847	9.7620227	10.2379773	58	2
3	9.6996258	9.9373116	9.7623142	10.2376858	57	3
4	9.6998441	9.9372385	9.7626056	10.2373944	56	4
5	9.7000622	9.9371653	9.7628969	10.2371031	55	5
6	9.7002802	9.9370921	9.7631881	10.2368119	54	6
7	9.7004981	9.9370189	9.7634792	10.2365208	53	7
8	9.7007158	9.9369456	9.7637702	10.2362298	52	8
9	9.7009334	9.9368722	9.7640612	10.2359388	51	9
10	9.7011508	9.9367988	9.7643520	10.2356480	50	10
11	9.7013681	9.9367254	9.7646427	10.2353573	49	11
12	9.7015852	9.9366519	9.7649334	10.2350666	48	12
13	9.7018022	9.9365783	9.7652239	10.2347761	47	13
14	9.7020190	9.9365047	9.7655143	10.2344857	46	14
15	9.7022357	9.9364311	9.7658047	10.2341953	45	15
16	9.7024523	9.9363574	9.7660949	10.2339051	44	16
17	9.7026687	9.9362836	9.7663851	10.2336149	43	17
18	9.7028849	9.9362098	9.7666751	10.2333249	42	18
19	9.7031011	9.9361360	9.7669651	10.2330349	41	19
20	9.7033170	9.9360621	9.7672550	10.2327450	40	20
21	9.7035329	9.9359881	9.7675448	10.2324552	39	21
22	9.7037486	9.9359141	9.7678344	10.2321656	38	22
23	9.7039641	9.9358401	9.7681240	10.2318760	37	23
24	9.7041795	9.9357660	9.7684135	10.2315865	36	24
25	9.7043947	9.9356918	9.7687029	10.2312971	35	25
26	9.7046099	9.9356177	9.7689922	10.2310078	34	26
27	9.7048248	9.9355434	9.7692814	10.2307186	33	27
28	9.7050397	9.9354691	9.7695705	10.2304295	32	28
29	9.7052543	9.9353948	9.7698596	10.2301404	31	29
30	9.7054689	9.9353204	9.7701485	10.2298515	30	30
31	9.7056833	9.9352459	9.7704373	10.2295627	29	31
32	9.7058975	9.9351715	9.7707261	10.2292739	28	32
33	9.7061116	9.9350969	9.7710147	10.2289853	27	33
34	9.7063256	9.9350223	9.7713033	10.2286967	26	34
35	9.7065394	9.9349477	9.7715917	10.2284083	25	35
36	9.7067531	9.9348730	9.7718801	10.2281199	24	36
37	9.7069667	9.9347983	9.7721684	10.2278316	23	37
38	9.7071801	9.9347235	9.7724566	10.2275434	22	38
39	9.7073933	9.9346486	9.7727447	10.2272553	21	39
40	9.7076064	9.9345738	9.7730327	10.2269673	20	40
41	9.7078194	9.9344988	9.7733206	10.2266794	19	41
42	9.7080323	9.9344238	9.7736084	10.2263916	18	42
43	9.7082450	9.9343488	9.7738961	10.2261039	17	43
44	9.7084575	9.9342737	9.7741838	10.2258162	16	44
45	9.7086699	9.9341986	9.7744713	10.2255287	15	45
46	9.7088822	9.9341234	9.7747588	10.2252412	14	46
47	9.7090943	9.9340482	9.7750462	10.2249538	13	47
48	9.7093063	9.9339729	9.7753334	10.2246666	12	48
49	9.7095182	9.9338976	9.7756206	10.2243794	11	49
50	9.7097299	9.9338222	9.7759077	10.2240923	10	50
51	9.7099415	9.9337467	9.7761947	10.2238053	9	51
52	9.7101529	9.9336713	9.7764816	10.2235184	8	52
53	9.7103642	9.9335957	9.7767685	10.2232315	7	53
54	9.7105753	9.9335201	9.7770552	10.2229448	6	54
55	9.7107863	9.9334445	9.7773418	10.2226582	5	55
56	9.7109972	9.9333688	9.7776284	10.2223716	4	56
57	9.7112080	9.9332931	9.7779149	10.2220851	3	57
58	9.7114186	9.9332173	9.7782012	10.2217988	2	58
59	9.7116290	9.9331415	9.7784875	10.2215125	1	59
60	9.7118393	9.9330656	9.7787737	10.2212263	0	60
	Cofine.	Sine.	Cotangent.	Tang.		

59 Degrees.

		31 Degrees.				
Min.	Sine.	Cofine.	Tang.	Cotangent.		Min.
0	9.7118393	9.9330656	9.7787737	10.2212263	60	0
1	9.7120495	9.9329897	9.7790599	10.2209401	59	1
2	9.7122596	9.9329137	9.7793459	10.2206541	58	2
3	9.7124695	9.9328376	9.7796318	10.2203682	57	3
4	9.7126792	9.9327616	9.7799177	10.2200823	56	4
5	9.7128889	9.9326854	9.7802034	10.2197966	55	5
6	9.7130983	9.9326092	9.7804891	10.2195109	54	6
7	9.7133077	9.9325330	9.7807747	10.2192253	53	7
8	9.7135169	9.9324567	9.7810602	10.2189398	52	8
9	9.7137260	9.9323804	9.7813456	10.2186544	51	9
10	9.7139349	9.9323040	9.7816309	10.2183691	50	10
11	9.7141437	9.9322276	9.7819162	10.2180838	49	11
12	9.7143524	9.9321511	9.7822013	10.2177987	48	12
13	9.7145609	9.9320746	9.7824864	10.2175136	47	13
14	9.7147693	9.9319980	9.7827713	10.2172287	46	14
15	9.7149776	9.9319213	9.7830562	10.2169438	45	15
16	9.7151857	9.9318447	9.7833410	10.2166590	44	16
17	9.7153937	9.9317679	9.7836258	10.2163742	43	17
18	9.7156015	9.9316911	9.7839104	10.2160896	42	18
19	9.7158092	9.9316143	9.7841949	10.2158051	41	19
20	9.7160168	9.9315374	9.7844794	10.2155206	40	20
21	9.7162243	9.9314605	9.7847638	10.2152362	39	21
22	9.7164316	9.9313835	9.7850481	10.2149519	38	22
23	9.7166387	9.9313065	9.7853323	10.2146677	37	23
24	9.7168458	9.9312294	9.7856164	10.2143836	36	24
25	9.7170526	9.9311522	9.7859004	10.2140996	35	25
26	9.7172594	9.9310750	9.7861844	10.2138156	34	26
27	9.7174660	9.9309978	9.7864682	10.2135318	33	27
28	9.7176725	9.9309205	9.7867520	10.2132480	32	28
29	9.7178789	9.9308432	9.7870357	10.2129643	31	29
30	9.7180851	9.9307658	9.7873193	10.2126807	30	30
31	9.7182912	9.9306883	9.7876028	10.2123972	29	31
32	9.7184971	9.9306109	9.7878863	10.2121137	28	32
33	9.7187030	9.9305333	9.7881696	10.2118304	27	33
34	9.7189086	9.9304557	9.7884529	10.2115471	26	34
35	9.7191142	9.9303781	9.7887361	10.2112639	25	35
36	9.7193196	9.9303004	9.7890192	10.2109808	24	36
37	9.7195249	9.9302226	9.7893023	10.2106977	23	37
38	9.7197300	9.9301448	9.7895852	10.2104148	22	38
39	9.7199350	9.9300670	9.7898681	10.2101319	21	39
40	9.7201399	9.9299891	9.7901508	10.2098492	20	40
41	9.7203447	9.9299112	9.7904335	10.2095665	19	41
42	9.7205493	9.9298332	9.7907161	10.2092839	18	42
43	9.7207538	9.9297551	9.7909987	10.2090013	17	43
44	9.7209581	9.9296770	9.7912811	10.2087189	16	44
45	9.7211623	9.9295989	9.7915635	10.2084365	15	45
46	9.7213664	9.9295207	9.7918458	10.2081542	14	46
47	9.7215704	9.9294424	9.7921280	10.2078720	13	47
48	9.7217742	9.9293641	9.7924101	10.2075899	12	48
49	9.7219779	9.9292857	9.7926921	10.2073079	11	49
50	9.7221814	9.9292073	9.7929741	10.2070259	10	50
51	9.7223848	9.9291289	9.7932560	10.2067440	9	51
52	9.7225881	9.9290504	9.7935378	10.2064622	8	52
53	9.7227913	9.9289718	9.7938195	10.2061805	7	53
54	9.7229943	9.9288932	9.7941011	10.2058989	6	54
55	9.7231972	9.9288145	9.7943827	10.2056173	5	55
56	9.7234000	9.9287358	9.7946641	10.2053359	4	56
57	9.7236026	9.9286571	9.7949455	10.2050545	3	57
58	9.7238051	9.9285783	9.7952268	10.2047732	2	58
59	9.7240075	9.9284994	9.7955081	10.2044919	1	59
60	9.7242097	9.9284205	9.7957892	10.2042108	0	60
	Cofine.	Sine.	Cotangent.	Tang.		

58 Degrees.

SINES.

Min.	32 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.7242097	9.9284205	9.7957892	10.2042108	60
1	9.7244118	9.9283415	9.7960703	10.2039297	59
2	9.7246138	9.9282625	9.7963513	10.2036487	58
3	9.7248156	9.9281834	9.7966322	10.2033678	57
4	9.7250174	9.9281043	9.7969130	10.2030870	56
5	9.7252189	9.9280251	9.7971938	10.2028062	55
6	9.7254204	9.9279459	9.7974745	10.2025255	54
7	9.7256217	9.9278666	9.7977551	10.2022449	53
8	9.7258229	9.9277873	9.7980356	10.2019644	52
9	9.7260240	9.9277079	9.7983160	10.2016840	51
10	9.7262249	9.9276285	9.7985964	10.2014036	50
11	9.7264257	9.9275490	9.7988767	10.2011233	49
12	9.7266264	9.9274695	9.7991569	10.2008431	48
13	9.7268269	9.9273899	9.7994370	10.2005630	47
14	9.7270273	9.9273103	9.7997170	10.2002830	46
15	9.7272276	9.9272306	9.7999970	10.2000030	45
16	9.7274278	9.9271509	9.8002769	10.1997231	44
17	9.7276278	9.9270711	9.8005567	10.1994433	43
18	9.7278277	9.9269913	9.8008365	10.1991635	42
19	9.7280275	9.9269114	9.8011161	10.1988839	41
20	9.7282271	9.9268314	9.8013957	10.1986043	40
21	9.7284267	9.9267514	9.8016752	10.1983248	39
22	9.7286260	9.9266714	9.8019546	10.1980454	38
23	9.7288253	9.9265913	9.8022340	10.1977660	37
24	9.7290244	9.9265112	9.8025133	10.1974867	36
25	9.7292234	9.9264310	9.8027925	10.1972075	35
26	9.7294223	9.9263507	9.8030716	10.1969284	34
27	9.7296211	9.9262704	9.8033506	10.1966494	33
28	9.7298197	9.9261901	9.8036296	10.1963704	32
29	9.7300182	9.9261096	9.8039085	10.1960915	31
30	9.7302165	9.9260292	9.8041873	10.1958127	30
31	9.7304148	9.9259487	9.8044661	10.1955339	29
32	9.7306129	9.9258681	9.8047447	10.1952553	28
33	9.7308109	9.9257875	9.8050233	10.1949767	27
34	9.7310087	9.9257069	9.8053019	10.1946981	26
35	9.7312064	9.9256261	9.8055803	10.1944197	25
36	9.7314040	9.9255454	9.8058587	10.1941413	24
37	9.7316015	9.9254646	9.8061370	10.1938630	23
38	9.7317989	9.9253837	9.8064152	10.1935848	22
39	9.7319961	9.9253028	9.8066933	10.1933067	21
40	9.7321932	9.9252218	9.8069714	10.1930286	20
41	9.7323902	9.9251408	9.8072494	10.1927506	19
42	9.7325870	9.9250597	9.8075273	10.1924727	18
43	9.7327837	9.9249786	9.8078052	10.1921948	17
44	9.7329803	9.9248974	9.8080829	10.1919171	16
45	9.7331768	9.9248161	9.8083606	10.1916394	15
46	9.7333731	9.9247349	9.8086383	10.1913617	14
47	9.7335693	9.9246535	9.8089158	10.1910842	13
48	9.7337654	9.9245721	9.8091933	10.1908067	12
49	9.7339614	9.9244907	9.8094707	10.1905293	11
50	9.7341572	9.9244092	9.8097480	10.1902520	10
51	9.7343529	9.9243277	9.8100253	10.1899747	9
52	9.7345485	9.9242461	9.8103025	10.1896975	8
53	9.7347440	9.9241644	9.8105796	10.1894204	7
54	9.7349393	9.9240827	9.8108566	10.1891434	6
55	9.7351345	9.9240010	9.8111336	10.1888664	5
56	9.7353296	9.9239191	9.8114105	10.1885895	4
57	9.7355246	9.9238373	9.8116873	10.1883127	3
58	9.7357195	9.9237554	9.8119641	10.1880359	2
59	9.7359142	9.9236734	9.8122408	10.1877592	1
60	9.7361088	9.9235914	9.8125174	10.1874826	0
	Cofine.	Sine.	Cotangent.	Tang.	

57 Degrees.

Min.	33 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.7361088	9.9235914	9.8125174	10.1874826	60
1	9.7363032	9.9235093	9.8127939	10.1872061	59
2	9.7364976	9.9234272	9.8130704	10.1869296	58
3	9.7366918	9.9233450	9.8133468	10.1866532	57
4	9.7368859	9.9232628	9.8136231	10.1863769	56
5	9.7370799	9.9231805	9.8138993	10.1861007	55
6	9.7372737	9.9230982	9.8141755	10.1858245	54
7	9.7374675	9.9230158	9.8144516	10.1855484	53
8	9.7376611	9.9229334	9.8147277	10.1852723	52
9	9.7378546	9.9228509	9.8150036	10.1849964	51
10	9.7380479	9.9227684	9.8152795	10.1847205	50
11	9.7382412	9.9226858	9.8155554	10.1844446	49
12	9.7384343	9.9226032	9.8158311	10.1841689	48
13	9.7386273	9.9225205	9.8161068	10.1838932	47
14	9.7388201	9.9224377	9.8163824	10.1836176	46
15	9.7390129	9.9223549	9.8166580	10.1833420	45
16	9.7392055	9.9222721	9.8169335	10.1830665	44
17	9.7393980	9.9221891	9.8172089	10.1827911	43
18	9.7395904	9.9221062	9.8174842	10.1825158	42
19	9.7397827	9.9220232	9.8177595	10.1822405	41
20	9.7399748	9.9219401	9.8180347	10.1819653	40
21	9.7401668	9.9218570	9.8183098	10.1816902	39
22	9.7403587	9.9217738	9.8185849	10.1814151	38
23	9.7405505	9.9216906	9.8188599	10.1811401	37
24	9.7407421	9.9216073	9.8191348	10.1808652	36
25	9.7409337	9.9215240	9.8194096	10.1805904	35
26	9.7411251	9.9214406	9.8196844	10.1803156	34
27	9.7413164	9.9213572	9.8199592	10.1800408	33
28	9.7415075	9.9212737	9.8202338	10.1797662	32
29	9.7416986	9.9211902	9.8205084	10.1794916	31
30	9.7418895	9.9211066	9.8207829	10.1792171	30
31	9.7420803	9.9210229	9.8210574	10.1789426	29
32	9.7422710	9.9209393	9.8213317	10.1786683	28
33	9.7424616	9.9208555	9.8216060	10.1783940	27
34	9.7426520	9.9207717	9.8218803	10.1781197	26
35	9.7428423	9.9206878	9.8221545	10.1778455	25
36	9.7430325	9.9206039	9.8224286	10.1775714	24
37	9.7432226	9.9205200	9.8227026	10.1772974	23
38	9.7434126	9.9204360	9.8229766	10.1770234	22
39	9.7436024	9.9203519	9.8232505	10.1767495	21
40	9.7437921	9.9202678	9.8235244	10.1764756	20
41	9.7439817	9.9201836	9.8237981	10.1762019	19
42	9.7441712	9.9200994	9.8240719	10.1759281	18
43	9.7443606	9.9200151	9.8243455	10.1756545	17
44	9.7445498	9.9199308	9.8246191	10.1753809	16
45	9.7447390	9.9198464	9.8248926	10.1751074	15
46	9.7449280	9.9197619	9.8251660	10.1748340	14
47	9.7451169	9.9196775	9.8254394	10.1745606	13
48	9.7453056	9.9195929	9.8257127	10.1742873	12
49	9.7454943	9.9195083	9.8259860	10.1740140	11
50	9.7456828	9.9194237	9.8262592	10.1737408	10
51	9.7458712	9.9193390	9.8265323	10.1734677	9
52	9.7460595	9.9192542	9.8268053	10.1731947	8
53	9.7462477	9.9191694	9.8270783	10.1729217	7
54	9.7464358	9.9190845	9.8273513	10.1726487	6
55	9.7466237	9.9189996	9.8276241	10.1723759	5
56	9.7468115	9.9189146	9.8278969	10.1721031	4
57	9.7469992	9.9188296	9.8281696	10.1718304	3
58	9.7471868	9.9187445	9.8284423	10.1715577	2
59	9.7473743	9.9186594	9.8287149	10.1712851	1
60	9.7475617	9.9185742	9.8289874	10.1710126	0
	Cofine.	Sine.	Cotangent.	Tang.	

56 Degrees.

SINES.

Min.	34 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.7475617	9.9185742	9.8289874	10.1710126	60
1	9.7477489	9.9184890	9.8292599	10.1707401	59
2	9.7479360	9.9184037	9.8295323	10.1704677	58
3	9.7481230	9.9183183	9.8298047	10.1701953	57
4	9.7483099	9.9182329	9.8300769	10.1699231	56
5	9.7484967	9.9181475	9.8303492	10.1696508	55
6	9.7486833	9.9180620	9.8306213	10.1693787	54
7	9.7488698	9.9179764	9.8308934	10.1691066	53
8	9.7490562	9.9178908	9.8311654	10.1688346	52
9	9.7492425	9.9178051	9.8314374	10.1685626	51
10	9.7494287	9.9177194	9.8317093	10.1682907	50
11	9.7496148	9.9176336	9.8319811	10.1680189	49
12	9.7498007	9.9175478	9.8322529	10.1677471	48
13	9.7499866	9.9174619	9.8325246	10.1674754	47
14	9.7501723	9.9173760	9.8327963	10.1672037	46
15	9.7503579	9.9172900	9.8330679	10.1669321	45
16	9.7505434	9.9172040	9.8333394	10.1666606	44
17	9.7507287	9.9171179	9.8336109	10.1663891	43
18	9.7509140	9.9170317	9.8338823	10.1661177	42
19	9.7510991	9.9169455	9.8341536	10.1658462	41
20	9.7512842	9.9168593	9.8344249	10.1655745	40
21	9.7514691	9.9167730	9.8346961	10.1653029	39
22	9.7516538	9.9166866	9.8349673	10.1650312	38
23	9.7518385	9.9166002	9.8352384	10.1647596	37
24	9.7520231	9.9165137	9.8355094	10.1644879	36
25	9.7522075	9.9164272	9.8357804	10.1642162	35
26	9.7523919	9.9163406	9.8360513	10.1639447	34
27	9.7525761	9.9162539	9.8363221	10.1636730	33
28	9.7527602	9.9161673	9.8365929	10.1634011	32
29	9.7529442	9.9160805	9.8368636	10.1631294	31
30	9.7531280	9.9159937	9.8371343	10.1628577	30
31	9.7533118	9.9159069	9.8374049	10.1625859	29
32	9.7534954	9.9158200	9.8376755	10.1623142	28
33	9.7536790	9.9157330	9.8379460	10.1620425	27
34	9.7538624	9.9156460	9.8382164	10.1617707	26
35	9.7540457	9.9155589	9.8384867	10.1615000	25
36	9.7542288	9.9154718	9.8387571	10.1612292	24
37	9.7544119	9.9153846	9.8390273	10.1609585	23
38	9.7545949	9.9152974	9.8392975	10.1606877	22
39	9.7547777	9.9152101	9.8395676	10.1604169	21
40	9.7549604	9.9151228	9.8398377	10.1601461	20
41	9.7551431	9.9150354	9.8401077	10.1598753	19
42	9.7553256	9.9149479	9.8403776	10.1596045	18
43	9.7555080	9.9148604	9.8406475	10.1593337	17
44	9.7556902	9.9147729	9.8409174	10.1590629	16
45	9.7558724	9.9146852	9.8411871	10.1587921	15
46	9.7560544	9.9145976	9.8414569	10.1585213	14
47	9.7562364	9.9145099	9.8417265	10.1582505	13
48	9.7564182	9.9144221	9.8419961	10.1579797	12
49	9.7565999	9.9143342	9.8422657	10.1577089	11
50	9.7567815	9.9142464	9.8425351	10.1574381	10
51	9.7569630	9.9141584	9.8428046	10.1571673	9
52	9.7571444	9.9140704	9.8430739	10.1568965	8
53	9.7573256	9.9139824	9.8433432	10.1566257	7
54	9.7575068	9.9138943	9.8436125	10.1563549	6
55	9.7576878	9.9138061	9.8438817	10.1560841	5
56	9.7578687	9.9137179	9.8441508	10.1558133	4
57	9.7580495	9.9136296	9.8444199	10.1555425	3
58	9.7582302	9.9135413	9.8446889	10.1552717	2
59	9.7584108	9.9134530	9.8449579	10.1550009	1
60	9.7585913	9.9133645	9.8452268	10.1547301	0
	Cofine.	Sine.	Cotangent.	Tang.	

55 Degrees.

Min.	35 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.7585913	9.9133645	9.8452268	10.1547301	60
1	9.7587717	9.9132760	9.8454956	10.1545044	59
2	9.7589519	9.9131875	9.8457644	10.1542787	58
3	9.7591321	9.9130989	9.8460332	10.1540530	57
4	9.7593122	9.9130102	9.8463018	10.1538273	56
5	9.7594920	9.9129215	9.8465705	10.1536016	55
6	9.7596718	9.9128328	9.8468390	10.1533759	54
7	9.7598515	9.9127440	9.8471075	10.1531502	53
8	9.7600311	9.9126551	9.8473760	10.1529245	52
9	9.7602106	9.9125662	9.8476444	10.1526988	51
10	9.7603899	9.9124772	9.8479127	10.1524731	50
11	9.7605692	9.9123882	9.8481810	10.1522474	49
12	9.7607483	9.9122991	9.8484492	10.1520217	48
13	9.7609274	9.9122099	9.8487174	10.1517960	47
14	9.7611063	9.9121207	9.8489855	10.1515703	46
15	9.7612851	9.9120315	9.8492536	10.1513446	45
16	9.7614638	9.9119422	9.8495216	10.1511189	44
17	9.7616424	9.9118528	9.8497896	10.1508932	43
18	9.7618208	9.9117634	9.8500575	10.1506675	42
19	9.7619992	9.9116739	9.8503253	10.1504418	41
20	9.7621775	9.9115844	9.8505931	10.1502161	40
21	9.7623556	9.9114948	9.8508608	10.1499904	39
22	9.7625337	9.9114051	9.8511285	10.1497647	38
23	9.7627116	9.9113155	9.8513961	10.1495390	37
24	9.7628894	9.9112257	9.8516637	10.1493133	36
25	9.7630671	9.9111359	9.8519312	10.1490876	35
26	9.7632447	9.9110460	9.8521987	10.1488619	34
27	9.7634222	9.9109561	9.8524661	10.1486362	33
28	9.7635996	9.9108661	9.8527335	10.1484105	32
29	9.7637769	9.9107761	9.8530008	10.1481848	31
30	9.7639540	9.9106860	9.8532680	10.1479591	30
31	9.7641311	9.9105959	9.8535352	10.1477334	29
32	9.7643080	9.9105057	9.8538023	10.1475077	28
33	9.7644849	9.9104155	9.8540694	10.1472820	27
34	9.7646616	9.9103251	9.8543365	10.1470563	26
35	9.7648382	9.9102348	9.8546034	10.1468306	25
36	9.7650147	9.9101444	9.8548704	10.1466049	24
37	9.7651911	9.9100539	9.8551372	10.1463792	23
38	9.7653674	9.9099634	9.8554041	10.1461535	22
39	9.7655436	9.9098728	9.8556708	10.1459278	21
40	9.7657197	9.9097821	9.8559376	10.1457021	20
41	9.7658957	9.9096915	9.8562042	10.1454764	19
42	9.7660715	9.9096007	9.8564708	10.1452507	18
43	9.7662473	9.9095099	9.8567374	10.1450250	17
44	9.7664229	9.9094190	9.8570039	10.1447993	16
45	9.7665985	9.9093281	9.8572704	10.1445736	15
46	9.7667739	9.9092371	9.8575368	10.1443479	14
47	9.7669492	9.9091461	9.8578031	10.1441222	13
48	9.7671244	9.9090550	9.8580694	10.1438965	12
49	9.7672996	9.9089639	9.8583357	10.1436708	11
50	9.7674746	9.9088727	9.8586019	10.1434451	10
51	9.7676494	9.9087814	9.8588680	10.1432194	9
52	9.7678242	9.9086901	9.8591341	10.1429937	8
53	9.7679989	9.9085988	9.8594002	10.1427680	7
54	9.7681735	9.9085073	9.8596661	10.1425423	6
55	9.7683480	9.9084159	9.8599321	10.1423166	5
56	9.7685223	9.9083243	9.8601980	10.1420909	4
57	9.7686966	9.9082327	9.8604638	10.1418652	3
58	9.7688707	9.9081411	9.8607296	10.1416395	2
59	9.7690448	9.9080494	9.8609954	10.1414138	1
60	9.7692187	9.9079576	9.8612610	10.1411881	0
	Cofine.	Sine.	Cotangent.	Tang.	

54 Degrees.

SINES.

Min.	36 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.7692187	9.9079576	9.8612610	10.1387390	60
1	9.7693925	9.9078658	9.8615267	10.1384733	59
2	9.7695662	9.9077740	9.8617923	10.1382077	58
3	9.7697398	9.9076820	9.8620578	10.1379422	57
4	9.7699134	9.9075901	9.8623233	10.1376767	56
5	9.7700868	9.9074980	9.8625887	10.1374113	55
6	9.7702601	9.9074059	9.8628541	10.1371459	54
7	9.7704332	9.9073138	9.8631195	10.1368805	53
8	9.7706063	9.9072216	9.8633848	10.1366152	52
9	9.7707793	9.9071293	9.8636500	10.1363500	51
10	9.7709522	9.9070370	9.8639152	10.1360848	50
11	9.7711249	9.9069446	9.8641803	10.1358197	49
12	9.7712976	9.9068522	9.8644454	10.1355546	48
13	9.7714702	9.9067597	9.8647105	10.1352895	47
14	9.7716426	9.9066671	9.8649755	10.1350245	46
15	9.7718150	9.9065745	9.8652404	10.1347596	45
16	9.7719872	9.9064819	9.8655053	10.1344947	44
17	9.7721593	9.9063892	9.8657702	10.1342298	43
18	9.7723314	9.9062964	9.8660350	10.1339650	42
19	9.7725033	9.9062036	9.8662997	10.1337003	41
20	9.7726751	9.9061107	9.8665644	10.1334356	40
21	9.7728468	9.9060177	9.8668291	10.1331709	39
22	9.7730185	9.9059247	9.8670937	10.1329063	38
23	9.7731900	9.9058317	9.8673583	10.1326417	37
24	9.7733614	9.9057386	9.8676228	10.1323772	36
25	9.7735327	9.9056454	9.8678873	10.1321127	35
26	9.7737039	9.9055522	9.8681517	10.1318483	34
27	9.7738749	9.9054589	9.8684160	10.1315840	33
28	9.7740459	9.9053656	9.8686804	10.1313196	32
29	9.7742168	9.9052722	9.8689446	10.1310554	31
30	9.7743876	9.9051787	9.8692089	10.1307911	30
31	9.7745583	9.9050852	9.8694731	10.1305269	29
32	9.7747288	9.9049916	9.8697372	10.1302628	28
33	9.7748993	9.9048980	9.8700013	10.1299987	27
34	9.7750697	9.9048043	9.8702653	10.1297347	26
35	9.7752399	9.9047106	9.8705293	10.1294707	25
36	9.7754101	9.9046168	9.8707933	10.1292067	24
37	9.7755801	9.9045230	9.8710572	10.1289428	23
38	9.7757501	9.9044291	9.8713210	10.1286790	22
39	9.7759199	9.9043351	9.8715848	10.1284152	21
40	9.7760897	9.9042411	9.8718486	10.1281514	20
41	9.7762593	9.9041470	9.8721123	10.1278877	19
42	9.7764289	9.9040529	9.8723760	10.1276240	18
43	9.7765983	9.9039587	9.8726396	10.1273604	17
44	9.7767676	9.9038644	9.8729032	10.1270968	16
45	9.7769369	9.9037701	9.8731668	10.1268332	15
46	9.7771060	9.9036757	9.8734302	10.1265698	14
47	9.7772750	9.9035813	9.8736937	10.1263063	13
48	9.7774439	9.9034868	9.8739571	10.1260429	12
49	9.7776128	9.9033923	9.8742204	10.1257796	11
50	9.7777815	9.9032977	9.8744838	10.1255162	10
51	9.7779501	9.9032031	9.8747470	10.1252530	9
52	9.7781186	9.9031084	9.8750102	10.1249898	8
53	9.7782870	9.9030136	9.8752734	10.1247266	7
54	9.7784553	9.9029188	9.8755365	10.1244635	6
55	9.7786235	9.9028239	9.8757996	10.1242004	5
56	9.7787916	9.9027289	9.8760627	10.1239373	4
57	9.7789596	9.9026339	9.8763257	10.1236743	3
58	9.7791275	9.9025389	9.8765886	10.1234114	2
59	9.7792953	9.9024438	9.8768515	10.1231485	1
60	9.7794630	9.9023486	9.8771144	10.1228856	0
	Cofine.	Sine.	Cotangent.	Tang.	

53 Degrees.

Min.	67 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.7794630	9.9023486	9.8771144	10.1228856	60
1	9.7796306	9.9022534	9.8773772	10.1226228	59
2	9.7797981	9.9021581	9.8776400	10.1223600	58
3	9.7799655	9.9020628	9.8779027	10.1220973	57
4	9.7801328	9.9019674	9.8781654	10.1218346	56
5	9.7803000	9.9018719	9.8784281	10.1215719	55
6	9.7804671	9.9017764	9.8786907	10.1213093	54
7	9.7806341	9.9016808	9.8789533	10.1210467	53
8	9.7808010	9.9015852	9.8792158	10.1207842	52
9	9.7809677	9.9014895	9.8794782	10.1205218	51
10	9.7811344	9.9013938	9.8797407	10.1202593	50
11	9.7813010	9.9012980	9.8800031	10.1199969	49
12	9.7814675	9.9012021	9.8802654	10.1197346	48
13	9.7816339	9.9011062	9.8805277	10.1194723	47
14	9.7818002	9.9010102	9.8807900	10.1192100	46
15	9.7819664	9.9009142	9.8810522	10.1189478	45
16	9.7821324	9.9008181	9.8813144	10.1186856	44
17	9.7822984	9.9007219	9.8815765	10.1184235	43
18	9.7824643	9.9006257	9.8818386	10.1181614	42
19	9.7826301	9.9005294	9.8821007	10.1178993	41
20	9.7827958	9.9004331	9.8823627	10.1176373	40
21	9.7829614	9.9003367	9.8826246	10.1173754	39
22	9.7831268	9.9002403	9.8828866	10.1171134	38
23	9.7832922	9.9001438	9.8831484	10.1168516	37
24	9.7834575	9.9000472	9.8834103	10.1165897	36
25	9.7836227	9.8999506	9.8836721	10.1163279	35
26	9.7837878	9.8998539	9.8839338	10.1160662	34
27	9.7839528	9.8997572	9.8841956	10.1158044	33
28	9.7841177	9.8996604	9.8844572	10.1155428	32
29	9.7842824	9.8995636	9.8847189	10.1152811	31
30	9.7844471	9.8994667	9.8849805	10.1150195	30
31	9.7846117	9.8993697	9.8852420	10.1147580	29
32	9.7847762	9.8992727	9.8855035	10.1144965	28
33	9.7849406	9.8991756	9.8857650	10.1142350	27
34	9.7851049	9.8990784	9.8860264	10.1139736	26
35	9.7852691	9.8989812	9.8862878	10.1137122	25
36	9.7854332	9.8988840	9.8865492	10.1134508	24
37	9.7855972	9.8987867	9.8868105	10.1131895	23
38	9.7857611	9.8986893	9.8870718	10.1129282	22
39	9.7859249	9.8985919	9.8873330	10.1126670	21
40	9.7860886	9.8984944	9.8875942	10.1124058	20
41	9.7862522	9.8983968	9.8878554	10.1121446	19
42	9.7864157	9.8982992	9.8881165	10.1118835	18
43	9.7865791	9.8982015	9.8883775	10.1116225	17
44	9.7867424	9.8981038	9.8886386	10.1113614	16
45	9.7869056	9.8980060	9.8888996	10.1111004	15
46	9.7870687	9.8979082	9.8891605	10.1108395	14
47	9.7872317	9.8978103	9.8894214	10.1105786	13
48	9.7873946	9.8977123	9.8896823	10.1103177	12
49	9.7875574	9.8976143	9.8899432	10.1100568	11
50	9.7877202	9.8975162	9.8902040	10.1097960	10
51	9.7878828	9.8974181	9.8904647	10.1095353	9
52	9.7880453	9.8973199	9.8907254	10.1092746	8
53	9.7882077	9.8972216	9.8909861	10.1090139	7
54	9.7883701	9.8971233	9.8912468	10.1087532	6
55	9.7885323	9.8970249	9.8915074	10.1084926	5
56	9.7886944	9.8969265	9.8917679	10.1082321	4
57	9.7888565	9.8968280	9.8920285	10.1079715	3
58	9.7890184	9.8967294	9.8922890	10.1077110	2
59	9.7891802	9.8966308	9.8925494	10.1074506	1
60	9.7893420	9.8965321	9.8928098	10.1071902	0
	Cofine.	Sine.	Cotangent.	Tang.	

52 Degrees.

SINES.

Min.	38 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.7893420	9.8965321	9.8928098	10.1071902	60
1	9.7895036	9.8964334	9.8930702	10.1069298	59
2	9.7896652	9.8963346	9.8933306	10.1066694	58
3	9.7898266	9.8962358	9.8935909	10.1064091	57
4	9.7899880	9.8961369	9.8938511	10.1061489	56
5	9.7901493	9.8960379	9.8941114	10.1058886	55
6	9.7903104	9.8959389	9.8943715	10.1056285	54
7	9.7904715	9.8958398	9.8946317	10.1053683	53
8	9.7906325	9.8957406	9.8948918	10.1051082	52
9	9.7907933	9.8956414	9.8951519	10.1048481	51
10	9.7909541	9.8955422	9.8954119	10.1045881	50
11	9.7911148	9.8954429	9.8956719	10.1043281	49
12	9.7912754	9.8953435	9.8959319	10.1040681	48
13	9.7914359	9.8952440	9.8961918	10.1038082	47
14	9.7915963	9.8951445	9.8964517	10.1035483	46
15	9.7917566	9.8950450	9.8967116	10.1032884	45
16	9.7919168	9.8949453	9.8969714	10.1030286	44
17	9.7920769	9.8948457	9.8972312	10.1027688	43
18	9.7922369	9.8947459	9.8974910	10.1025090	42
19	9.7923968	9.8946461	9.8977507	10.1022493	41
20	9.7925566	9.8945463	9.8980104	10.1019896	40
21	9.7927163	9.8944464	9.8982700	10.1017300	39
22	9.7928760	9.8943464	9.8985296	10.1014704	38
23	9.7930355	9.8942463	9.8987892	10.1012108	37
24	9.7931949	9.8941462	9.8990487	10.1009513	36
25	9.7933543	9.8940461	9.8993082	10.1006918	35
26	9.7935135	9.8939458	9.8995677	10.1004323	34
27	9.7936727	9.8938456	9.8998271	10.1001729	33
28	9.7938317	9.8937452	9.9000865	10.0999135	32
29	9.7939907	9.8936448	9.9003459	10.0996541	31
30	9.7941496	9.8935444	9.9006052	10.0993948	30
31	9.7943083	9.8934439	9.9008645	10.0991355	29
32	9.7944670	9.8933433	9.9011237	10.0988763	28
33	9.7946256	9.8932426	9.9013830	10.0986170	27
34	9.7947841	9.8931419	9.9016422	10.0983578	26
35	9.7949425	9.8930412	9.9019013	10.0980987	25
36	9.7951008	9.8929404	9.9021604	10.0978396	24
37	9.7952590	9.8928395	9.9024195	10.0975805	23
38	9.7954171	9.8927385	9.9026786	10.0973214	22
39	9.7955751	9.8926375	9.9029376	10.0970624	21
40	9.7957330	9.8925365	9.9031966	10.0968034	20
41	9.7958909	9.8924354	9.9034555	10.0965445	19
42	9.7960486	9.8923342	9.9037144	10.0962856	18
43	9.7962062	9.8922329	9.9039733	10.0960267	17
44	9.7963638	9.8921316	9.9042321	10.0957679	16
45	9.7965212	9.8920303	9.9044910	10.0955090	15
46	9.7966786	9.8919289	9.9047497	10.0952503	14
47	9.7968359	9.8918274	9.9050085	10.0949915	13
48	9.7969930	9.8917258	9.9052672	10.0947328	12
49	9.7971501	9.8916242	9.9055259	10.0944741	11
50	9.7973071	9.8915226	9.9057845	10.0942155	10
51	9.7974640	9.8914208	9.9060431	10.0939569	9
52	9.7976208	9.8913191	9.9063017	10.0936983	8
53	9.7977775	9.8912172	9.9065603	10.0934397	7
54	9.7979341	9.8911153	9.9068188	10.0931812	6
55	9.7980906	9.8910133	9.9070773	10.0929227	5
56	9.7982470	9.8909113	9.9073357	10.0926643	4
57	9.7984034	9.8908092	9.9075941	10.0924059	3
58	9.7985596	9.8907071	9.9078525	10.0921475	2
59	9.7987158	9.8906049	9.9081109	10.0918891	1
60	9.7988718	9.8905026	9.9083692	10.0916308	0
	Cofine.	Sine.	Cotangent.	Tang.	

51 Degrees.

Min.	39 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.7988718	9.8905026	9.9083692	10.0916308	60
1	9.7990278	9.8904003	9.9086275	10.0913725	59
2	9.7991836	9.8902979	9.9088858	10.0911142	58
3	9.7993394	9.8901954	9.9091440	10.0908560	57
4	9.7994951	9.8900929	9.9094022	10.0905978	56
5	9.7996507	9.8899903	9.9096603	10.0903397	55
6	9.7998062	9.8898877	9.9099185	10.0900815	54
7	9.7999616	9.8897850	9.9101766	10.0898234	53
8	9.8001169	9.8896822	9.9104347	10.0895653	52
9	9.8002721	9.8895794	9.9106929	10.0893073	51
10	9.8004272	9.8894765	9.9109507	10.0890493	50
11	9.8005823	9.8893736	9.9112087	10.0887913	49
12	9.8007372	9.8892706	9.9114666	10.0885334	48
13	9.8008921	9.8891675	9.9117245	10.0882755	47
14	9.8010468	9.8890644	9.9119824	10.0880176	46
15	9.8012015	9.8889612	9.9122403	10.0877597	45
16	9.8013561	9.8888580	9.9124981	10.0875019	44
17	9.8015106	9.8887547	9.9127559	10.0872441	43
18	9.8016649	9.8886513	9.9130137	10.0869863	42
19	9.8018192	9.8885479	9.9132714	10.0867286	41
20	9.8019735	9.8884444	9.9135291	10.0864709	40
21	9.8021276	9.8883408	9.9137868	10.0862132	39
22	9.8022816	9.8882372	9.9140444	10.0859556	38
23	9.8024355	9.8881335	9.9143020	10.0856980	37
24	9.8025894	9.8880298	9.9145596	10.0854404	36
25	9.8027431	9.8879260	9.9148171	10.0851829	35
26	9.8028968	9.8878221	9.9150747	10.0849253	34
27	9.8030504	9.8877182	9.9153322	10.0846678	33
28	9.8032038	9.8876142	9.9155896	10.0844104	32
29	9.8033572	9.8875102	9.9158471	10.0841529	31
30	9.8035105	9.8874061	9.9161045	10.0838955	30
31	9.8036637	9.8873019	9.9163618	10.0836382	29
32	9.8038168	9.8871977	9.9166192	10.0833808	28
33	9.8039699	9.8870934	9.9168765	10.0831235	27
34	9.8041228	9.8869890	9.9171338	10.0828662	26
35	9.8042757	9.8868846	9.9173911	10.0826089	25
36	9.8044284	9.8867801	9.9176483	10.0823517	24
37	9.8045811	9.8866756	9.9179055	10.0820945	23
38	9.8047336	9.8865710	9.9181627	10.0818373	22
39	9.8048861	9.8864663	9.9184198	10.0815802	21
40	9.8050385	9.8863616	9.9186769	10.0813231	20
41	9.8051908	9.8862568	9.9189340	10.0810660	19
42	9.8053430	9.8861519	9.9191911	10.0808089	18
43	9.8054951	9.8860470	9.9194481	10.0805519	17
44	9.8056472	9.8859420	9.9197051	10.0802949	16
45	9.8057991	9.8858370	9.9199621	10.0800379	15
46	9.8059510	9.8857319	9.9202191	10.0797809	14
47	9.8061027	9.8856267	9.9204760	10.0795240	13
48	9.8062544	9.8855215	9.9207329	10.0792671	12
49	9.8064060	9.8854162	9.9209898	10.0790102	11
50	9.8065575	9.8853109	9.9212466	10.0787534	10
51	9.8067089	9.8852055	9.9215034	10.0784966	9
52	9.8068602	9.8851000	9.9217602	10.0782398	8
53	9.8070114	9.8849945	9.9220170	10.0779830	7
54	9.8071626	9.8848889	9.9222737	10.0777263	6
55	9.8073136	9.8847832	9.9225304	10.0774696	5
56	9.8074646	9.8846775	9.9227871	10.0772129	4
57	9.8076154	9.8845717	9.9230437	10.0769563	3
58	9.8077662	9.8844659	9.9233004	10.0766996	2
59	9.8079169	9.8843599	9.9235570	10.0764430	1
60	9.8080675	9.8842540	9.9238135	10.0761865	0
	Cofine.	Sine.	Cotangent.	Tang.	

50 Degrees.

SINES.

Min.	40 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.8080675	9.8842540	9.9238135	10.0761845	60
1	9.8082180	9.8841479	9.9240701	10.0759299	59
2	9.8083684	9.8840418	9.9243266	10.0756734	58
3	9.8085188	9.8839357	9.9245831	10.0754169	57
4	9.8086690	9.8838294	9.9248396	10.0751604	56
5	9.8088192	9.8837232	9.9250960	10.0749040	55
6	9.8089692	9.8836168	9.9253524	10.0746476	54
7	9.8091192	9.8835104	9.9256088	10.0743912	53
8	9.8092691	9.8834039	9.9258652	10.0741348	52
9	9.8094189	9.8832974	9.9261215	10.0738785	51
10	9.8095686	9.8831908	9.9263778	10.0736222	50
11	9.8097182	9.8830841	9.9266341	10.0733659	49
12	9.8098678	9.8829774	9.9268904	10.0731096	48
13	9.8100172	9.8828706	9.9271466	10.0728534	47
14	9.8101666	9.8827638	9.9274028	10.0725972	46
15	9.8103159	9.8826568	9.9276590	10.0723410	45
16	9.8104650	9.8825499	9.9279152	10.0720848	44
17	9.8106141	9.8824428	9.9281713	10.0718287	43
18	9.8107631	9.8823357	9.9284274	10.0715726	42
19	9.8109121	9.8822285	9.9286835	10.0713165	41
20	9.8110609	9.8821213	9.9289396	10.0710604	40
21	9.8112096	9.8820140	9.9291956	10.0708044	39
22	9.8113583	9.8819067	9.9294516	10.0705484	38
23	9.8115069	9.8817992	9.9297076	10.0702924	37
24	9.8116554	9.8816918	9.9299636	10.0700364	36
25	9.8118038	9.8815842	9.9302195	10.0697805	35
26	9.8119521	9.8814766	9.9304755	10.0695245	34
27	9.8121003	9.8813689	9.9307314	10.0692686	33
28	9.8122484	9.8812612	9.9309872	10.0690128	32
29	9.8123965	9.8811534	9.9312431	10.0687569	31
30	9.8125444	9.8810455	9.9314989	10.0685011	30
31	9.8126923	9.8809376	9.9317547	10.0682453	29
32	9.8128401	9.8808296	9.9320105	10.0679895	28
33	9.8129878	9.8807215	9.9322662	10.0677338	27
34	9.8131354	9.8806134	9.9325220	10.0674780	26
35	9.8132829	9.8805052	9.9327777	10.0672223	25
36	9.8134303	9.8803970	9.9330334	10.0669666	24
37	9.8135777	9.8802887	9.9332890	10.0667110	23
38	9.8137250	9.8801803	9.9335446	10.0664554	22
39	9.8138721	9.8800719	9.9338003	10.0661997	21
40	9.8140192	9.8799634	9.9340559	10.0659441	20
41	9.8141662	9.8798548	9.9343114	10.0656886	19
42	9.8143131	9.8797462	9.9345670	10.0654330	18
43	9.8144600	9.8796375	9.9348225	10.0651775	17
44	9.8146067	9.8795287	9.9350780	10.0649220	16
45	9.8147534	9.8794199	9.9353335	10.0646665	15
46	9.8148999	9.8793110	9.9355889	10.0644111	14
47	9.8150464	9.8792021	9.9358444	10.0641556	13
48	9.8151928	9.8790930	9.9360998	10.0639002	12
49	9.8153391	9.8789840	9.9363552	10.0636448	11
50	9.8154854	9.8788748	9.9366105	10.0633895	10
51	9.8156315	9.8787656	9.9368659	10.0631341	9
52	9.8157776	9.8786563	9.9371212	10.0628788	8
53	9.8159235	9.8785470	9.9373765	10.0626235	7
54	9.8160692	9.8784376	9.9376318	10.0623682	6
55	9.8162152	9.8783281	9.9378871	10.0621129	5
56	9.8163609	9.8782186	9.9381423	10.0618577	4
57	9.8165066	9.8781090	9.9383975	10.0616025	3
58	9.8166521	9.8779994	9.9386527	10.0613473	2
59	9.8167975	9.8778896	9.9389079	10.0610921	1
60	9.8169429	9.8777799	9.9391631	10.0608369	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

49 Degrees.

Min.	41 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.8169429	9.8777799	9.9391631	10.0608369	60
1	9.8170882	9.8776700	9.9394182	10.0605818	59
2	9.8172334	9.8775601	9.9396733	10.0603267	58
3	9.8173785	9.8774501	9.9399284	10.0600716	57
4	9.8175235	9.8773401	9.9401835	10.0598165	56
5	9.8176685	9.8772300	9.9404385	10.0595615	55
6	9.8178133	9.8771198	9.9406936	10.0593064	54
7	9.8179581	9.8770096	9.9409486	10.0590514	53
8	9.8181028	9.8768993	9.9412036	10.0587964	52
9	9.8182474	9.8767889	9.9414585	10.0585415	51
10	9.8183919	9.8766785	9.9417135	10.0582865	50
11	9.8185364	9.8765680	9.9419684	10.0580316	49
12	9.8186807	9.8764574	9.9422233	10.0577767	48
13	9.8188250	9.8763468	9.9424782	10.0575218	47
14	9.8189692	9.8762361	9.9427331	10.0572669	46
15	9.8191133	9.8761253	9.9429879	10.0570121	45
16	9.8192573	9.8760145	9.9432428	10.0567572	44
17	9.8194012	9.8759036	9.9434976	10.0565024	43
18	9.8195450	9.8757927	9.9437524	10.0562476	42
19	9.8196888	9.8756816	9.9440072	10.0559928	41
20	9.8198325	9.8755706	9.9442619	10.0557381	40
21	9.8199761	9.8754594	9.9445166	10.0554834	39
22	9.8201196	9.8753482	9.9447714	10.0552286	38
23	9.8202630	9.8752369	9.9450261	10.0549739	37
24	9.8204063	9.8751256	9.9452807	10.0547193	36
25	9.8205496	9.8750142	9.9455354	10.0544646	35
26	9.8206927	9.8749027	9.9457900	10.0542100	34
27	9.8208358	9.8747912	9.9460447	10.0539553	33
28	9.8209788	9.8746795	9.9462993	10.0537007	32
29	9.8211217	9.8745679	9.9465539	10.0534461	31
30	9.8212646	9.8744561	9.9468084	10.0531916	30
31	9.8214073	9.8743443	9.9470630	10.0529370	29
32	9.8215500	9.8742325	9.9473175	10.0526825	28
33	9.8216926	9.8741205	9.9475720	10.0524280	27
34	9.8218351	9.8740085	9.9478265	10.0521735	26
35	9.8219775	9.8738965	9.9480810	10.0519190	25
36	9.8221198	9.8737844	9.9483355	10.0516645	24
37	9.8222621	9.8736722	9.9485899	10.0514101	23
38	9.8224042	9.8735600	9.9488443	10.0511557	22
39	9.8225463	9.8734477	9.9490987	10.0509013	21
40	9.8226883	9.8733352	9.9493531	10.0506469	20
41	9.8228302	9.8732227	9.9496075	10.0503925	19
42	9.8229721	9.8731102	9.9498619	10.0501381	18
43	9.8231138	9.8729976	9.9501162	10.0498838	17
44	9.8232555	9.8728849	9.9503705	10.0496295	16
45	9.8233971	9.8727722	9.9506248	10.0493752	15
46	9.8235386	9.8726594	9.9508791	10.0491209	14
47	9.8236800	9.8725466	9.9511334	10.0488666	13
48	9.8238213	9.8724337	9.9513876	10.0486124	12
49	9.8239626	9.8723207	9.9516419	10.0483581	11
50	9.8241037	9.8722076	9.9518961	10.0481039	10
51	9.8242448	9.8720945	9.9521503	10.0478497	9
52	9.8243858	9.8719813	9.9524045	10.0475955	8
53	9.8245267	9.8718681	9.9526587	10.0473413	7
54	9.8246676	9.8717548	9.9529128	10.0470872	6
55	9.8248083	9.8716414	9.9531670	10.0468330	5
56	9.8249490	9.8715279	9.9534211	10.0465789	4
57	9.8250896	9.8714144	9.9536752	10.0463248	3
58	9.8252301	9.8713008	9.9539293	10.0460707	2
59	9.8253705	9.8711872	9.9541834	10.0458166	1
60	9.8255109	9.8710735	9.9544374	10.0455626	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

48 Degrees.

SINES.

Min.	42 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.8255109	9.8710735	9.9544374	10.0455626	60
1	9.8256512	9.8709597	9.9546915	10.0453085	59
2	9.8257913	9.8708458	9.9549455	10.0450545	58
3	9.8259314	9.8707319	9.9551995	10.0448005	57
4	9.8260715	9.8706179	9.9554535	10.0445465	56
5	9.8262114	9.8705039	9.9557075	10.0442925	55
6	9.8263512	9.8703898	9.9559615	10.0440385	54
7	9.8264910	9.8702756	9.9562154	10.0437846	53
8	9.8266307	9.8701613	9.9564694	10.0435306	52
9	9.8267703	9.8700470	9.9567233	10.0432767	51
10	9.8269098	9.8699326	9.9569772	10.0430228	50
11	9.8270493	9.8698182	9.9572311	10.0427689	49
12	9.8271887	9.8697037	9.9574850	10.0425150	48
13	9.8273279	9.8695891	9.9577389	10.0422611	47
14	9.8274671	9.8694744	9.9579927	10.0420073	46
15	9.8276063	9.8693597	9.9582465	10.0417535	45
16	9.8277453	9.8692449	9.9585004	10.0414996	44
17	9.8278843	9.8691301	9.9587542	10.0412458	43
18	9.8280231	9.8690152	9.9590080	10.0409920	42
19	9.8281619	9.8689002	9.9592618	10.0407382	41
20	9.8283006	9.8687851	9.9595155	10.0404845	40
21	9.8284393	9.8686700	9.9597693	10.0402307	39
22	9.8285778	9.8685548	9.9600230	10.0399770	38
23	9.8287163	9.8684396	9.9602767	10.0397233	37
24	9.8288547	9.8683242	9.9605305	10.0394695	36
25	9.8289930	9.8682088	9.9607842	10.0392158	35
26	9.8291312	9.8680934	9.9610378	10.0389622	34
27	9.8292694	9.8679779	9.9612915	10.0387085	33
28	9.8294075	9.8678623	9.9615452	10.0384548	32
29	9.8295454	9.8677466	9.9617988	10.0382012	31
30	9.8296833	9.8676309	9.9620525	10.0379475	30
31	9.8298212	9.8675151	9.9623061	10.0376939	29
32	9.8299589	9.8673992	9.9625597	10.0374403	28
33	9.8300966	9.8672833	9.9628133	10.0371867	27
34	9.8302342	9.8671673	9.9630669	10.0369331	26
35	9.8303717	9.8670512	9.9633204	10.0366796	25
36	9.8305091	9.8669351	9.9635740	10.0364260	24
37	9.8306464	9.8668189	9.9638275	10.0361725	23
38	9.8307837	9.8667026	9.9640811	10.0359189	22
39	9.8309209	9.8665863	9.9643346	10.0356654	21
40	9.8310580	9.8664699	9.9645881	10.0354119	20
41	9.8311950	9.8663534	9.9648416	10.0351584	19
42	9.8313320	9.8662369	9.9650951	10.0349049	18
43	9.8314688	9.8661203	9.9653486	10.0346514	17
44	9.8316056	9.8660036	9.9656020	10.0343980	16
45	9.8317423	9.8658868	9.9658555	10.0341445	15
46	9.8318789	9.8657700	9.9661089	10.0338911	14
47	9.8320155	9.8656531	9.9663623	10.0336377	13
48	9.8321519	9.8655362	9.9666157	10.0333843	12
49	9.8322883	9.8654192	9.9668692	10.0331308	11
50	9.8324246	9.8653021	9.9671225	10.0328775	10
51	9.8325609	9.8651849	9.9673759	10.0326241	9
52	9.8326970	9.8650677	9.9676293	10.0323707	8
53	9.8328331	9.8649504	9.9678827	10.0321173	7
54	9.8329691	9.8648331	9.9681360	10.0318640	6
55	9.8331050	9.8647156	9.9683893	10.0316107	5
56	9.8332408	9.8645981	9.9686427	10.0313573	4
57	9.8333766	9.8644806	9.9688960	10.0311040	3
58	9.8335122	9.8643629	9.9691493	10.0308507	2
59	9.8336478	9.8642452	9.9694026	10.0305974	1
60	9.8337833	9.8641275	9.9696559	10.0303441	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

47 Degrees.

Min.	43 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.8337833	9.8641275	9.9696559	10.0303441	60
1	9.8339188	9.8640096	9.9699091	10.0300909	59
2	9.8340541	9.8638917	9.9701624	10.0298376	58
3	9.8341894	9.8637737	9.9704157	10.0295843	57
4	9.8343246	9.8636557	9.9706689	10.0293311	56
5	9.8344597	9.8635376	9.9709221	10.0290779	55
6	9.8345948	9.8634194	9.9711754	10.0288246	54
7	9.8347297	9.8633011	9.9714286	10.0285714	53
8	9.8348646	9.8631828	9.9716818	10.0283182	52
9	9.8349994	9.8630644	9.9719350	10.0280650	51
10	9.8351341	9.8629460	9.9721882	10.0278118	50
11	9.8352688	9.8628274	9.9724413	10.0275587	49
12	9.8354033	9.8627088	9.9726945	10.0273055	48
13	9.8355378	9.8625902	9.9729477	10.0270523	47
14	9.8356722	9.8624714	9.9732008	10.0267992	46
15	9.8358066	9.8623526	9.9734539	10.0265461	45
16	9.8359408	9.8622338	9.9737071	10.0262929	44
17	9.8360750	9.8621148	9.9739602	10.0260398	43
18	9.8362091	9.8619958	9.9742133	10.0257867	42
19	9.8363431	9.8618767	9.9744664	10.0255336	41
20	9.8364771	9.8617576	9.9747195	10.0252805	40
21	9.8366109	9.8616383	9.9749726	10.0250274	39
22	9.8367447	9.8615190	9.9752257	10.0247743	38
23	9.8368784	9.8613997	9.9754787	10.0245213	37
24	9.8370121	9.8612803	9.9757318	10.0242682	36
25	9.8371456	9.8611608	9.9759849	10.0240151	35
26	9.8372791	9.8610412	9.9762379	10.0237621	34
27	9.8374125	9.8609215	9.9764909	10.0235090	33
28	9.8375458	9.8608018	9.9767440	10.0232560	32
29	9.8376790	9.8606821	9.9769970	10.0230030	31
30	9.8378122	9.8605622	9.9772500	10.0227500	30
31	9.8379453	9.8604423	9.9775030	10.0224970	29
32	9.8380783	9.8603223	9.9777560	10.0222440	28
33	9.8382112	9.8602022	9.9780090	10.0219910	27
34	9.8383441	9.8600821	9.9782620	10.0217380	26
35	9.8384769	9.8609619	9.9785149	10.0214851	25
36	9.8386096	9.8608416	9.9787679	10.0212321	24
37	9.8387422	9.8607213	9.9790209	10.0209791	23
38	9.8388747	9.8606009	9.9792738	10.0207262	22
39	9.8390072	9.8604804	9.9795268	10.0204732	21
40	9.8391396	9.8603599	9.9797797	10.0202203	20
41	9.8392719	9.8602393	9.9800326	10.0199674	19
42	9.8394041	9.8601186	9.9802856	10.0197144	18
43	9.8395363	9.8600000	9.9805385	10.0194615	17
44	9.8396684	9.8598814	9.9807914	10.0192086	16
45	9.8398004	9.8597628	9.9810443	10.0189557	15
46	9.8399323	9.8596441	9.9812972	10.0187028	14
47	9.8400642	9.8595255	9.9815501	10.0184499	13
48	9.8401959	9.8594068	9.9818030	10.0181970	12
49	9.8403276	9.8592881	9.9820559	10.0179441	11
50	9.8404593	9.8591694	9.9823087	10.0176912	10
51	9.8405908	9.8590507	9.9825616	10.0174384	9
52	9.8407223	9.8589320	9.9828145	10.0171855	8
53	9.8408537	9.8588133	9.9830673	10.0169327	7
54	9.8409850	9.8586946	9.9833202	10.0166798	6
55	9.8411162	9.8585759	9.9835730	10.0164270	5
56	9.8412474	9.8584572	9.9838259	10.0161741	4
57	9.8413785	9.8583385	9.9840787	10.0159213	3
58	9.8415095	9.8582198	9.9843315	10.0156685	2
59	9.8416404	9.8581011	9.9845844	10.0154156	1
60	9.8417713	9.8579824	9.9848372	10.0151628	0
	Cofine.	Sine.	Cotangent.	Tang.	Min.

46 Degrees.

Min.	44 Degrees.				Min.
	Sine.	Cofine.	Tang.	Cotangent.	
0	9.8417715	9.8569349	9.9848372	10.0151628	60
1	9.8419021	9.8568121	9.9850900	10.0149100	59
2	9.8420328	9.8566900	9.9853428	10.0146752	58
3	9.8421634	9.8565678	9.9855956	10.0144404	57
4	9.8422939	9.8564455	9.9858484	10.0141516	56
5	9.8424244	9.8563232	9.9861012	10.0138988	55
6	9.8425548	9.8562008	9.9863540	10.0136460	54
7	9.8426851	9.8560784	9.9866068	10.0133932	53
8	9.8428154	9.8559558	9.9868596	10.0131404	52
9	9.8429456	9.8558332	9.9871123	10.0128877	51
10	9.8430757	9.8557106	9.9873651	10.0126349	50
11	9.8432057	9.8555878	9.9876179	10.0123821	49
12	9.8433356	9.8554650	9.9878706	10.0121294	48
13	9.8434655	9.8553421	9.9881234	10.0118766	47
14	9.8435953	9.8552192	9.9883761	10.0116239	46
15	9.8437250	9.8550961	9.9886289	10.0113711	45
16	9.8438547	9.8549730	9.9888816	10.0111184	44
17	9.8439842	9.8548499	9.9891344	10.0108656	43
18	9.8441137	9.8547266	9.9893871	10.0106129	42
19	9.8442432	9.8546033	9.9896399	10.0103601	41
20	9.8443725	9.8544799	9.9898926	10.0101074	40
21	9.8445018	9.8543564	9.9901453	10.0098547	39
22	9.8446310	9.8542329	9.9903981	10.0096019	38
23	9.8447601	9.8541093	9.9906508	10.0093492	37
24	9.8448891	9.8539856	9.9909035	10.0090965	36
25	9.8450181	9.8538619	9.9911562	10.0088438	35
26	9.8451470	9.8537381	9.9914089	10.0085911	34
27	9.8452758	9.8536142	9.9916616	10.0083384	33
28	9.8454045	9.8534902	9.9919143	10.0080857	32
29	9.8455332	9.8533662	9.9921670	10.0078330	31
30	9.8456618	9.8532421	9.9924197	10.0075803	30
31	9.8457903	9.8531179	9.9926724	10.0073276	29
32	9.8459188	9.8529936	9.9929251	10.0070749	28
33	9.8460471	9.8528693	9.9931778	10.0068222	27
34	9.8461754	9.8527449	9.9934305	10.0065695	26
35	9.8463036	9.8526204	9.9936832	10.0063168	25
36	9.8464318	9.8524959	9.9939359	10.0060641	24
37	9.8465599	9.8523713	9.9941886	10.0058114	23
38	9.8466879	9.8522466	9.9944413	10.0055587	22
39	9.8468158	9.8521218	9.9946940	10.0053060	21
40	9.8469436	9.8519970	9.9949466	10.0050533	20
41	9.8470714	9.8518721	9.9951993	10.0048007	19
42	9.8471991	9.8517471	9.9954520	10.0045480	18
43	9.8473267	9.8516220	9.9957047	10.0042953	17
44	9.8474543	9.8514969	9.9959573	10.0040427	16
45	9.8475817	9.8513717	9.9962100	10.0037900	15
46	9.8477091	9.8512465	9.9964627	10.0035373	14
47	9.8478365	9.8511211	9.9967154	10.0032846	13
48	9.8479637	9.8509957	9.9969680	10.0030320	12
49	9.8480909	9.8508702	9.9972207	10.0027793	11
50	9.8482180	9.8507446	9.9974734	10.0025266	10
51	9.8483450	9.8506190	9.9977260	10.0022740	9
52	9.8484720	9.8504933	9.9979787	10.0020213	8
53	9.8485989	9.8503675	9.9982314	10.0017686	7
54	9.8487257	9.8502417	9.9984840	10.0015160	6
55	9.8488524	9.8501157	9.9987367	10.0012633	5
56	9.8489791	9.8499897	9.9989893	10.0010107	4
57	9.8491057	9.8498637	9.9992420	10.0007580	3
58	9.8492322	9.8497375	9.9994947	10.0005053	2
59	9.8493586	9.8496113	9.9997473	10.0002527	1
60	9.8494850	9.8494850	10.0000000	10.0000000	0
	Cofine.	Sine.	Cotangent.	Tang.	

45 Degrees.

SINE of Incidence, in *Catoptrics* and *Dioptrics*, is used for the sine of the angle of incidence.

SINE of Reflection, in *Catoptrics*, is used for the sine of the angle of reflection.

SINE of Refraction, in *Dioptrics*, is used for the sine of the angle of refraction.

SINE *assensu capituli*, in *Law*, a writ that lies where a bishop, dean, prebendary, or master of an hospital, aliens the lands holden in right of his bishopric, deanery, house, &c. without the assent of the chapter or fraternity; in which case his successor shall have this writ.

SINE-CURES, are ecclesiastical benefices, without cure of souls. Their original was as follows: The rector (with proper consent) had a power to intitle a vicar in his church to officiate under him; and this was often done: and by this means, two persons were instituted to the same church and both to the cure of souls, and both did actually officiate. So that however the rectors of sine-cures, by having been long excused from residence, are in common opinion discharged from the cure of souls, (which is the reason of the name,) and however the cure is said in the law-books to be in them *habitualiter* only; yet in strictness, and with regard to their original institution, the cure is in them *actualiter*, as much as it is in the vicar. *Gibf.* 719. *Johnf.* 85.

That is to say, where they come in by institution; but if the rectory is a donative, the case is otherwise: for then coming in by donation, they have not the cure of souls committed to them. And these are most properly sine-cures, according to the genuine signification of the word. *Johnf.* 85.

No church where there is but one incumbent can properly be a sine-cure: and though the church being down, or the parish being become destitute of parishioners, the incumbent may be thereby necessarily acquitted from the actual performance of public duty, yet he is still under an obligation to do it, whenever a church shall be built, and there is a competent number of inhabitants; and, in the mean while, if the church be presentative, as most of such churches are, the incumbent is instituted into the cure of souls. Such benefices are rather depopulations than sine-cures; and it will be proper for the new incumbent to read the thirty-nine articles, and the liturgy, in the church-yard, &c. and to do whatever other incumbents usually do.

But a rectory, or portion of it, may properly be a sine-cure, if there be a vicar under the rector, endowed and charged with the cure; in which case it does not come within the statute of pluralities, 21 Hen. VIII. c. 13.

Here, therefore, no dispensation is necessary to hold the sine-cure with a former living; nor need the incumbent read the articles, or divine service, as required by 13 Eliz. c. 12. which extends only to a benefice with cure.

A sine-cure donative wants no institution and induction, but one presentative must have both, especially if it consist in glebe and tithes, and not in a portion of money; but the institution must not run in *curam animarum*, but in *rectoriam, sive portionem rectoria de A. B. &c.*

By the above-mentioned statute (21 Hen. VIII.) not only prebends, and rectories with vicarages endowed, but deaneries and archdeaconries are declared to be benefices *without cure*.

SINE DIE, in *Law*. When judgment is given against the plaintiff, he is said to be *in misericordia pro falso clamore suo*; and for the defendant, it is said, *eat inde sine die*; i. e. he is dismissed the court.

The phrase is also used in parliament, for the adjournment

ment of any debate, without fixing the day when it shall come on again; which is looked upon as a genteeler dismissal of the thing in question.

SINEER, in *Geography*, a town of Hindoostan, in Baglana; 3 miles W. of Junere.

SINEGAR CREEK, a river of Maryland, which runs into the Potomack, N. lat. $39^{\circ} 8'$. W. long. $77^{\circ} 33'$.

SINEMAHONING, a north-west branch of the river Susquehanna.

SINE PARI, in *Anatomy*, an epithet applied to the vena azygos, which latter is an equivalent expression derived from the Greek. It means the *single vein*; as there is only one in the body, and not a pair, as in general, consisting of a right and left vessel. See **VEIN**.

SINEPUMENT INLET, in *Geography*, a bay on the S.E. coast of Maryland. N. lat. $38^{\circ} 20'$.

SINERVAS, in *Ancient Geography*, a town of the Lesser Armenia, on the route from Satala to Melitene, between Carfagis and Analiba. It. of Anton.

SINES, in *Geography*, a sea-port town of Portugal, in Eltremadura, containing about 1400 inhabitants; 39 miles S. of Setuval. N. lat. $37^{\circ} 46'$. W. long. $8^{\circ} 51'$.

SINESCLA, a town of Asiatic Turkey, in the province of Diarbekir; 80 miles E. of Rabba.

SINEU, a town of the island of Majorea; 20 miles E. of Parma.

SINEW properly denotes what we call a *nerve*; though, in common speech, it is rather used for a *tendon*.

The Hebrews do not eat the sinew of the thighs of animals, in memory of the sinew of Jacob's thigh, which the angel touched. This abstinence is not commanded by the law, and some interpreters think that it is an act of voluntary devotion.

SINEW, in the *Manege*. To unfinew a horse, called in French *enerver*, is to cut the two tendons on the side of the head, about five inches under the eyes; which two join in one at the tip, or the end of the nose, in order to perform its motion. This tendon at the tip of the nose is likewise cut. We unfinew, in order to dry the head, and make it smaller.

SINEW-Shrunk, is said of a horse that is over-rid, and so worn down with fatigue, that he becomes gaunt-bellied, through a stiffness and contraction of the two sinews that are under his belly.

SINEW-Sprung, is a violent attain, or over-reach, in which a horse strikes the toe of his hinder feet against the sinew of the fore-legs.

SINF, in the *Materia Medica of the Ancients*, a word used to express the same as *agallochum*, or lignum aloes.

SIN-FONG, in *Geography*, a town of China, of the third rank, in Kiang-fi; 27 miles S. of Kan-cheou.

SING, a town of Dalmatia, built by the Turks, in opposition to Clissa. It was strongly fortified; and the Venetians, after taking this place in the year 1686, strengthened its fortifications, in order to secure it to themselves; 16 miles N. of Spalatro.—Also, a town of Corea; 153 miles S.S.E. of King-ki-tao. N. lat. $35^{\circ} 27'$. E. long. $127^{\circ} 49'$.—Also, a town of Corea; 25 miles S.E. of Long-Kouang.

SINGA, in *Ancient Geography*, a town of Syria, in the Comagene. Ptolemy.

SIN-GAN, in *Geography*, a city of China, of the first rank, and capital of the province of Chen-fi; next to Peking, one of the largest and most beautiful cities in the kingdom. Its walls are thick, very high, and four leagues in circumference; they are flanked with a great number of towers, and surrounded by a deep ditch. Some of its gates are magnificent and remarkably lofty. In this city is still

seen a palace where the ancient kings of Chen-fi resided, the extent of whose country, and the bravery of their people, once rendered them formidable to their neighbours. The houses are, according to the Chinese fashion, low and ill-constructed; and the furniture, on account of the scarcity of good artists, inferior to that in the southern provinces; porcelain being very rare, and the varnish coarse. The inhabitants are generally more robust, and brave, and better formed for enduring fatigue, and also of greater stature, than those of the other provinces. The principal Tartar forces destined for the defence of the northern part of the empire are garrisoned in this city, under a general of their own nation, who, with his soldiers, occupies a quarter of the city, separated from the rest by a wall. Bats of a singular species are found in the territories of Sin-gan; they are as large as domestic fowls, and the Chinese prefer their flesh to that of the most delicate chickens. This country also furnishes the ladies with a white paint, which they use for embellishing their complexions. It appears, by an inscription on a marble monument dug up here in 1625, that the Christian religion flourished in China from the year 636 to 782. This capital has 37 cities under its jurisdiction; six of the second class and 31 of the third. The Mandarins, who are numerous in this city, are mostly Tartars. N. lat: $35^{\circ} 14'$. E. long. $108^{\circ} 29'$. Grofier.—Also, a town of China, of the third rank, in Pe-tche-li; 22 miles E.N.E. of Pao-ting.

SINGANA, in *Botany*, Aubl. Guian. 574. Just. 257, altered by Aublet from the name *Singan Singa*, given by the blacks in Guiana to the fruit of this shrub. See **STERBECKIA**.

SINGANELLORE, in *Geography*, a town of Hindoostan, in Coimbetore; 5 miles E. of Coimbetore.

SINGAPETTY, a town of Hindoostan; 17 miles S.S.W. of Tinevelly.

SINGARA, **SINJER**, in *Ancient Geography*, an important town of Asia, in Mesopotamia, on the banks of the river Mygdonius. Dion Cassius says that it was taken by Trajan; and that it afterwards became a Roman colony, under the appellations of Aurelia and Septimia, which it bears on medals.

SINGARPETTY, in *Geography*, a town of Hindoostan, in Barramaul; 25 miles E.N.E. of Dairempoury.

SINGARPILLY, a town of Hindoostan, in Myfore; 23 miles E.S.E. of Chinna Balabaram.

SINGAS, **SINSJA**, in *Ancient Geography*, a river of Asia, which, according to Ptolemy, flowed from Pieria, the most northerly canton of Syria, and discharged itself into the Euphrates S.E. of Samofata, between Arudis and Porfica.

SINGBOON, in *Geography*, a circar of Hindoostan, of small extent, bounded N.E. and E. by Bengal, S. by Mohurbunge, W. and N.W. by Bahar.

SINGEAH, a town of Hindoostan, in Bahar; 10 miles N. of Hajypour. N. lat. $25^{\circ} 52'$. E. long. $85^{\circ} 24'$.

SINGECOLLAM, a town of Hindoostan; 10 miles S. of Tinevelly.

SINGECONDA, a town of Hindoostan, in the Carnatic; 25 miles N. of Ongole.

SINGEE, a town of Hindoostan, in Bahar; 24 miles S.S.E. of Durbungah. N. lat. $25^{\circ} 45'$. E. long. $86^{\circ} 21'$.

SINGERAM, a town of Hindoostan, in Goleonda; 15 miles S.E. of Hydrabad.

SINGERBILL, a town of Hindoostan, in Bengal; 30 miles N. of Cormillah.

SINGERS, in the *Jewish Antiquities*. See **CHANTOR**.

SINGERS in Lulli's operas. See **LULLI**.

SINGESECKEN, in *Geography*, a town of Norway,

in the province of Drontheim; 46 miles S.S.W. of Drontheim.

SINGFING, a town of America, in New York, on the river Hudson; 27 miles N. of New York. N. lat. $41^{\circ} 8'$. W. long. $73^{\circ} 53'$.

SINGHOLE, a town of Hindoostan, in Gurry Mundella; 36 miles N.N.W. of Gurrah.

SINGHORE, a town of Hindoostan, in Oude; 16 miles S.E. of Manickpour.

SINGHYA, a town of Hindoostan, in Bahar; 10 miles N. of Hajypour.

SINGILIEV, a town of Russia, in the government of Simbirsk, on the Volga; 24 miles S. of Simbirsk. N. lat. $54^{\circ} 1'$. E. long. $48^{\circ} 34'$.

SINGING, the act of making divers inflexions of the voice, agreeable to the ear, and corresponding to the notes of a song, or piece of melody.

The Greek musicians, says Dr. Smith in his Harmonics, p. 3. note *c*, rightly describe the difference between the manner of singing and that of talking. They considered two motions in the voice; the one continued, and used in talking; the other discrete, and used in singing. In the continued motion, the voice never rests at any certain pitch, but waves up and down by insensible degrees; and in the discrete motion it does the contrary, frequently resting or staying at certain places, and leaping from one to another by sensible intervals. Euclid's *Introductio Harmonica*, p. 2. In the former case, the vibrations of the air are continually accelerated and retarded by turns, and by very small degrees, and in the latter by large ones.

The first thing done, in learning to sing, is to raise a scale of notes, by tones and semitones, to an octave; and descend again by the same notes; and then to rise and fall by greater intervals, as a 3d, 4th, and 5th, and to do all this by notes of different pitch.

Then these notes are represented by lines and spaces, to which the syllables *fa, sol, la, mi*, are applied, and the pupil is taught to name each line and space by them; whence this practice is usually called *sol-fa-ing*. The nature, reason, defects, &c. of which, see under the article SOL-FA-ING.

For the history of singing, as a part of religious worship, see *Choral SERVICE*.

SINGING, *Proceffional*. It was about the year 386, during the persecution of the orthodox Christians by the empress Justina, mother to the then young emperor Valentinian II. that ecclesiastical music was introduced in favour of the Arians. "At this time," says St. Augustine, "it was first ordered that hymns and psalms should be sung after the manner of eastern nations, that the people might not languish and pine away with a tedious sorrow, and from that time to the present it is retained at Milan, and imitated by almost all the other congregations of the world."

Music is said by some of the fathers to have drawn the Gentiles frequently into the church through mere curiosity; who liked its ceremonies so well, that they were baptized before their departure. The generality of our parochial music is not likely to produce similar effects; being such as would sooner drive Christians with good ears *out* of the church, than draw Pagans *into* it.

About this time, during the contention between the orthodox Christians and the Arians, we find by Socrates the historian, (l. vi. c. 8.) that the heretics used to sing hymns, marching through the streets of Constantinople in procession, with which the vulgar were so much captivated, that the orthodox, under the direction of St. Chryostom, thought it necessary to follow the example which had been set them

by their greatest enemies. Proceffional singing had been long practised by the Pagans, but no mention is made of it among Christians before this period.

SINGING *in the Church by the primitive Christians*. With respect to the music that was first used by the Christians, or established in the church by the first emperors that were converted, as no specimens remain, it is difficult to determine of what kind it was. That some part of the sacred music of the apostles and their immediate successors, in Palestine and the adjacent countries, may have been such as was used by the Hebrews, particularly in chanting the psalms, is probable; but it is no less probable that the music of the hymns which were first received in the church, wherever Paganism had prevailed, resembled that which had been many ages used in the temple-worship of the Greeks and Romans. Of this, the verification of those hymns affords an indisputable proof, as it by no means resembles that of the psalms, or of any other Hebrew poetry. And examples may be found in all the breviaries, missals, and antiphonaries, ancient and modern, of every species of verification which has been practised by the Greek and Roman poets, particularly the lyric; such as the Alcmæian, Alcaic, Sapphic, &c.

St. Hilary, bishop of Poitiers, and St. Ambrose, are said to have been the first that composed hymns to be sung in the western churches. Both these fathers flourished about the middle of the fourth century; but Prudentius, a Christian poet, contemporary with Theodosius, who died in 395, was author of most of the hymns in the Roman breviary.

SINGING, *Celestial*. It seems as if the primitive Christians had had no conceptions more sublime of the employment of the blest in the celestial abode, than that they were eternally singing. The ancient hymn, "Te Deum laudamus," still retained in the church, appears to have furnished the poet Dante with a model of the 28th canto of his "Paradiso," where, under three different hierarchies, consisting each of three choirs or choruses, the heavenly host of cherubim and seraphim are singing perpetual hosannahs. Milton has assigned them the same employment:

————— Their golden harps they took:
Harps ever tun'd, that glittering by their side
Like quivers hung, and with preamble sweet
Of charming symphony they introduce
Their sacred song, and waken raptures high;
No voice exempt, no voice but well could join
Melodious part, such concord is in heaven.

Parad. Lost, book iii.

Orazio Benivoli composed, in the last century, a mass for the cessation of the plague at Rome, upon the same idea, for six choirs, of four parts each, the score consisting of twenty-four different parts: it was performed in St. Peter's church, of which he was maestro di capella, and the singers, amounting to more than two hundred, were arranged in different circles of the dome; the sixth choir occupying the summit of the cupola.

SINGING *in England by Madrigalists*. Choral compositions, madrigals, and songs in that style, always of many parts, being the only vocal music that was in favour with masters and their most powerful patrons, precluded all refinement in the performance: as fugues, canons, and full choruses, of which they chiefly consisted, are founded upon democratic principles, which admit of no sovereignty; and whatever good they contain, is equally distributed to all ranks in the musical state; the art of singing, therefore, in these times, further than was necessary to keep a performer in tune and time, must have been unknown: the possessor of the most exquisite voice had no more frequent opportunities

allowed

allowed of displaying it, than the most disagreeable; solo songs, anthems, and cantatas, being productions of later times. The penalty for the crime of playing a solo at the concert of ancient music was five guineas; but at this time, if instead of that sum being forfeited, five hundred had been offered to the individual who could perform such a feat, fewer candidates would have entered the lists than if the like premium had been offered for flying from Salisbury steeple over Old Sarum, without a balloon.

SINGING, Parochial. See PSALMODY. See also STERNHOLD and HOPKINS.

SINGING in Italy, during the 16th century. Zacconi, one of the best Italian writers on music of that period, in his "Prattica di Musica," published 1596, chiefly dwells, in the first book, on the superiority of the singing and fingers of his own time, over all that preceded them; and has a long chapter upon the manner of gracing and embellishing a melody, where he tells us, "Che stile si tenghi nel far di gorgia; dell' uso de i moderni *passaggi*, come si *fioriscino* le cantilene;" and speaks of *acconciature*, as the modern Italians do of *rifforamenti*, or graces. The divisions, however, into which he breaks passages, in order to *embellish* them, if adopted by an opera-singer of the present times, would be like a modern fine lady appearing at court in the furbelows and flounces of queen Elizabeth, or a fine gentleman in the peruke of sir Cloudesley Shovel.

SINGING in France, during the 17th century. See MERSENNUS, and ST. EVREMOND.

SINGING in England, previous to the reign of queen Anne.

Music at all times has been called in to the assistance of weak plays and unattractive actors in our national theatres; and incidental songs, and singing between the acts, have been found so alluring, that when there was no plan formed for exhibiting musical dramas, singers have been engaged at considerable salaries, expressly for that purpose.

Before the last century, the art of singing, indeed, seems to have been little cultivated among us, by either sex, beyond what concerned time and tune. The honourable Roger North, in his manuscript "Memoirs of Music," speaks of the younger Banister as an excellent singing-master; but the players, who sung Purcell's songs on the stage, seem to have had nothing but voice and action to recommend them: such as Bowen, Harris, Freeman, and Pate, among the men; and among the women, Mrs. Davies, Miss Shore, afterwards wife to Colley Cibber, Mrs. Cross, Miss Champion, and Mrs. Bracegirdle. It was, however, a powerful recommendation to a song, during the 17th century, to say that it had been performed at the playhouse. How different from modern times! Church music, by the gay and fastidious frequenters of the opera, before, as well as after it had been heard, is pronounced to be *old-fashioned*, and playhouse music *vulgar*. Till the reign of queen Anne, indeed, the gentlemen of the chapel royal were occasionally allowed to sing on the stage; but that princes thinking the practice indecent, prohibited its continuance. There are few instances of vocal performers, especially female, being brought on our stage, but by accident. The fear of seduction, profligacy, and the world's opinion, deters parents from educating their children with a view to a profession, which nothing but uncommon success and prudence can render honourable in the eyes of the most serious part of the nation. The generality of female singers, therefore, having every thing to learn after leisure for study is no longer in their power, usually remain ignorant of the principles of their art, and so totally dependent on a master, as to be obliged to perpetuate that apprenticeship, which ought to have been served before they let up for themselves.

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In 1763, the pasticcio burletta of "Love in a Village," and in 1765 "The Summer's Tale," and "The Maid of the Mill," betrayed us into a taste for Italian melody, which has been the model of most of our vocal composers in and out of the theatre ever since. The "Duenna," another favourite English pasticcio, in 1775, helped us on, and Dr. Arnold, Mr. Dibdin, and Mr. Shield, have very judiciously complied with the reigning taste, and imitated or adopted the opera style in all its vicissitudes. Linley of Bath, and Jackson of Exeter, in their elegies at least, have steadfastly adhered to a style of their own, which seems to have been formed upon the melodies of our best old English masters, and those of the last age, that were most worthy of being preserved.

Till the Italian opera was established in this country, little was expected of a singer besides voice and an ear. Indeed, long after that period, good taste in singing was so little diffused throughout the island, that the great and exquisite performers who came hither from the continent seem to have made but a small impression on their astonished hearers. Nicolini, Senesino, Bernacchi, Faustina, Cuzzoni, Farnelli, Caffarelli, Carestini, Conti, Monticelli, Mingotti, Elizi, Manzoli, Guarducci, and Guadagni, had no effect upon our national taste; and though a few individuals among the people of fashion, by private instructions from them, and by the best of all lessons, hearing them frequently perform in public, diminished the original sin of our native *brogue* and vulgar expression; yet as these pupils could be heard but by few, their power was local, and no more likely to have any general effect upon our national cantilena, than their learning French and Italian upon our general language. It is not difficult, however, to fix the era of a change in our vocal music, which seems to have remained stationary for near half a century. It was begun by the compositions and instructions of Dr. Arne, who endeavoured to refine our melody and singing, more from Italian than English models; and was greatly accelerated by the pasticcio English operas above mentioned, as well as by the instructions of Tedeschi, Cocchi, Vento, and Giardini, who were employed about this time to teach several of our playhouse singers. Tenducci's performance in Artaxerxes had a rapid effect upon the public taste, and stimulated to imitation all that were possessed of good ears and flexible voices. In later times, the scholars of Sacchini, Piozzi, Parsons, and others, with the public concerts, where the best compositions and most exquisite performances of all kinds were constantly heard, completed the revolution; and it may be with truth and certainty affirmed, that our taste and judgment in both, even at the playhouses, differ as much from those of twenty or thirty years ago, as the manners of a civilized people from those of savages.

SINGING of Birds. See SONG of Birds.

SINGINGING, in *Geography*, a small island in the East Indian sea, near the E. coast of the island of Nassau. S. lat. 3° 50'. E. long. 100° 2'.

SINGITICUS SINUS, in *Ancient Geography*, a gulf of Macedonia, in the Ægean sea.

SINGIVENDA, in *Geography*, a town of Hindoostan, in the Carnatic; 28 miles N.N.W. of Ongole.

SINGLE, among *Sportsmen*, the tail of any of the deer kind.

SINGLE Bond or Obligation, *simplex obligatio*, in *Law*, is a deed, by which the obligor obliges himself, his heirs, executors, and administrators, to pay a certain sum of money to another at a day appointed. See OBLIGATION.

SINGLE Cast, in *Husbandry*, a term used by farmers for that

that sort of sowing, that disperses the necessary quantity of corn at one bout.

SINGLE Echo, Fine, Position, Proposition, Rasters, Tenaille, and Voucher. See the substantives.

SINGLE-Horse Carts, in *Agriculture.* See **CART.**

SINGLES. See **PETTY Singles.**

SINGO, in *Geography,* a town of European Turkey, in the province of Macedonia, near mount Athos.

SINGON, an island near the coast of Sweden, at the entrance into the gulf of Finland. N. lat. $60^{\circ} 11'$. E. long. $18^{\circ} 20'$.

SINGOONMAW, a town of the Birman empire; 16 miles S. of Pegongmew.

SINGOR, a sea-port town of Asia, in the kingdom of Siam, on the coast of Malacca. N. lat. $6^{\circ} 40'$. E. long. $101^{\circ} 14'$.

SINGPINE, a town of Bengal; 25 miles S.E. of Natore.

SINGPOUR, a town of Bengal; 22 miles E.S.E. of Ramgur.—Also, a town of Bengal; 8 miles S.E. of Koonda.—Also, a town of Hindoostan, in the circar of Sohajepour; 8 miles S. of Sohajepour.

SINGRAMOW, a town of Hindoostan, in Oude; 24 miles S.S.E. of Sultanpour.

SINGRECOTTA, a town of Hindoostan, in the circar of Cicacole; 23 miles W. of Vizianagram.

SINGREMOM, a town of Hindoostan, in Allahabad; 23 miles N.N.E. of Gazypour.

SINGREPETTA, a town of Hindoostan, in the Carnatic; 15 miles S.E. of Trichinopoly.

SINGROWLA, a town of Hindoostan, in Allahabad, S.W. of Bahar.

SING-SING, a town of America, in the state of New York; 35 miles N. of New York.

SINGUAR, a town of Hindoostan, in Bahar; 14 miles E.N.E. of Hajypour.

SINGUE, a town of Hindoostan, in Bahar; 38 miles S. of Bahar.

SINGULAR NUMBER, in *Grammar,* the first manner of declining nouns, and conjugating verbs; used when we only speak of a single person or thing. See **NUMBER.**

SINGULAR History. See **HISTORY.**

SINGULAR Proposition. See **PROPOSITION.**

SINGULARIS, or **SINGLE,** in the *Manege,* a name given by the Romans to a horse, upon which a man rode, in their races, without a saddle, using only a cloth, like the Greeks, fastened with a surcingle, or else sitting upon the bare back.

SINGULATOR, among the Romans, a horseman who rode with one horse only.

SINGULTUS, in *Medicine,* a spasmodic affection of the diaphragm, which, from the sound which accompanies it, is commonly called *hiccup*; under which head see an ample account of this affection.

SINGUM, in *Geography,* a town of Hindoostan, in the Carnatic; 23 miles S.S.W. of Trichinopoly.

SINGUR, a town of Hindoostan, in Bahar; 35 miles S.E. of Gaybah.—Also, a town of Hindoostan, in Vissapour; 12 miles S. of Poonah.

SINGUS, in *Ancient Geography,* a town of Macedonia, in Chalcidic, on the Singitic gulf. Ptol.

SING-Y, in *Geography,* a town of China, of the third rank, in Quang-tong; 17 miles N. of Kao-tcheou.

SINHALA, in *Ancient Geography,* a name formerly given to the island of Ceylon, formed from the Sanscrit *Sinha,* a lion, and given to it on account of its being in-

habited by Sinhalas, or the offspring of a lion. See *Asiatic Researches,* vol. i. p. 48.

SIN-HIANG, in *Geography,* a town of China, of the third rank, in Ho-nan, on the river Ki; 12 miles S.W. of Oue-kiun.

SIN-HING, a small island near the coast of China, in the Eastern sea; 3 miles S. of Tfong-ming. N. lat. $31^{\circ} 32'$. E. long. 121° .—Also, a town of China, of the third rank, in Quang-tong; 27 miles S. of Tchao-king.—Also, a city of China, of the second rank, in Yun-nan. N. lat. $24^{\circ} 30'$. E. long. $102^{\circ} 23'$.

SIN-HO, a town of China, of the third rank, in Petchie-li; 15 miles S.W. of Kli.

SIN-HOA, a sea-port town of Cochinchina. N. lat. 17° . E. long. $88^{\circ} 14'$.—Also, a town of China, of the third rank, in Hou-quang, on the river Lo; 32 miles N.N.W. of Pao-king.

SIN-HOEI, a town of China, of the third rank, in Quang-tong; 40 miles N.W. of Macao.—Also, a town of China, of the third rank, in Quang-tong; 45 miles S.S.E. of Tchao-king.

SINIA, a river of Russia, which runs into the Oby, 52 miles N. of Berezov, N. lat. 65° . E. long. $66^{\circ} 14'$.

SINJAR, a town of Asiatic Turkey, in the province of Diarbekir; 140 miles S.E. of Diarbekir. N. lat. $36^{\circ} 17'$. E. long. $41^{\circ} 35'$.—Also, a range of mountains, in the province of Diarbekir; 70 miles S.E. of Diarbekir. On this range stood the fortrefs of Sangara, which was surrendered to the Persians by the pusillanimous successor of Julian, about eight or ten miles from Nisibis. This mountain is at present peopled by several tribes of that sect called Yezedi, who worship, or rather deprecate, the devil, from a notion that he possesses an unlimited power over mankind.

They are the descendants of those Arabs who followed the banners of Yezid, and fought against Hafein, in the battle of Kerbela; and Sheikh Ade, the founder of the sect, is interred near Mosul. They are said to adore the Supreme Being as the creator and benefactor of the human race, drink wine and other strong liquors, and circumcise like the Mahometans. They are the mortal enemies of the Turks, and have never been completely subdued. They lie in ambush behind the rising grounds, which skirt the road between Mosul and Merdin; and as travellers are obliged to pass a lonely wild, 20 furlongs in length, they are liable, if not numerously attended, to be murdered by these miscreants. Sinjar affords abundance of pasturage, and also a sufficient quantity of grain for the consumption of its savage inhabitants. In the year 341 a bloody battle was fought near this place, between the emperor Constantius and Sapor II., in which the former sustained a total defeat, and was driven by his victorious rival across the Euphrates.

SINIA STANITZ, a town of Russia, in the government of Irkutsk, on the Lena. N. lat. $61^{\circ} 15'$. E. long. $125^{\circ} 34'$.

SINICA, a town of America, in South Carolina, belonging to the Cherokee Indians, on the Keowe; 43 miles N.W. of Petersburg.

SINICAL QUADRANT. See **QUADRANT.**

SINIGAGLIA, in *Geography,* a sea-port town of Italy, in the duchy of Urbino, the see of a bishop, suffragan of Urbino, on the Adriatic, at the mouth of the river Nivola (anciently Senon), which separates the duchy of Urbino from the marquise of Ancona. It was anciently called "Sena Gallorum," denoting that it was built by the Gallic Senones, and became a Roman colony in the year of Rome 462. It has been several times destroyed, especially

by the Goths. It contains four churches and six convents, with about 6000 inhabitants. It is an unhealthy place, and water fit for drinking is scarce; 28 miles E.S.E. of Urbino.

SINJIAR. See SINJAR.

SIN-ING, a town of Corea; 25 miles E.S.E. of Long-Kouang.

SI-NING, a town of Corea; 8 miles N.E. of Sing-tcheou.—Also, a city of China, of the second rank, in Chen-fi. N. lat. $36^{\circ} 40'$. E. long. $101^{\circ} 24'$.—Also, a town of China, of the third rank, in Pe-tche-li; 25 miles N.W. of Yu-tcheou.—Also, a town of China, of the third rank, in Quang-tong; 15 miles S.W. of Te-king.

SINION, a river of China, which runs into the Kialing, 15 miles S. of Oei-tcheou.

SINIS COLONIA, in *Ancient Geography*, a town of Asia, in Lesser Armenia, near the Euphrates, according to Ammianus Marcellinus.

SINISCOLA, in *Geography*, a town of Sardinia, on the east coast. N. lat. $40^{\circ} 30'$. E. long. $10^{\circ} 1'$.

SINISI, a town of Naples, in Basilicata; 11 miles S.W. of Turfi.

SINISTER, something on, or towards the left hand.

Hence some derive the word finitser, a *finendo*, because the gods, by such auguries, permit us to proceed in our designs.

SINISTER is also used among us for unlucky; though, in the sacred rites of divination, the Romans used it in an opposite sense. Thus, *avis sinistra*, or a bird on the left hand, was esteemed a happy omen; whence, in the law of the Twelve Tables, *Ave sinistra populi magister esto*.

SINISTER, in *Heraldry*. The finitser side of an escutcheon is the side answering to the right hand of the person who looks at it.

SINISTER Chief and Base. See ESCUTCHEON.

SINISTER Bend. See BEND.

SINISTER Aspect, among *Astrologers*, is an appearance of two planets, happening according to the succession of the signs; as Saturn in Aries, and Mars in the same degree of Gemini.

SINISTRARI, a sect of ancient heretics, thus called, because they held the left hand in abhorrence, and made it a point of religion not to receive any thing with it.

What in us is a piece of civility, in them was a superstition. Balsamon observes, that they were likewise called Sabbatians and Novatians.

SINKBAZAR, in *Geography*, a town of Bengal; 15 miles S.S.W. of Rogonatpour.

SINKEL, a sea-port town of the island of Sumatra, near the west coast, on a river which runs into the sea. This town is a good mart for salt, iron, steel, and sometimes opium. N. lat. $2^{\circ} 8'$. E. long. 97° .

SINKING of the Earth. See ABSORPTIONS of the Earth.

SINKING Fund. See FUND.

SINKOO, in the *Materia Medica*, a name given by some authors to the lignum aloes, or agallochum, used in medicine.

SINKOUANG, in *Geography*, a town on the west coast of Sumatra. N. lat. $1^{\circ} 12'$. E. long. $98^{\circ} 13'$.

SIN-LO, a town of China, of the third rank, in Pe-tche-li, on the Chao river; 42 miles S.W. of Pao-ting.

SINN, a river of Germany, which runs into the Maine, with the Saal, near Gemunden, in the duchy of Wurzburg.—Also, a town of Asiatic Turkey, in the province of Diarbekir; 40 miles S.E. of Diarbekir.

SINNEMAHONING CREEK, a river of America, in

Pennsylvania, which runs into the west branch of the Susquehanna, N. lat. $41^{\circ} 17'$. W. long. 78° .

SINNERSHAUSEN, a town of Germany, in the county of Henneberg; 8 miles N.W. of Meinungen.

SINNET, aboard a Ship. See SENNET.

SIN-NGHAN, in *Geography*, a town of China, of the third rank, in Ho-nan; 17 miles W. of Ho-nan.

SIN-NHING, a town of China, of the third rank, in Hou-quang; 20 miles S.S.W. of Oukang.

SIN-NING, a town of China, of the third rank, in Quang-tong; 52 miles S. of Tchao-king.—Also, a town of China, of the third rank, in Se-tchuen; 17 miles E.S.E. of Ta.—Also, a city of China, of the second rank, in Quang-fi. N. lat. $22^{\circ} 34'$. E. long. $107^{\circ} 17'$.

SINNO, a river of Naples, which runs into the Adriatic, N. lat. 40° . E. long. $16^{\circ} 40'$. Near the mouth of the Sinno was Siris, probably the port of Heraclea; but at present there is nothing but an open road, where ships may lie to take in a cargo of corn, and other commodities, of which one is liquorice, a root that grows wild in great quantities along these swamps, and the sale of which is said to have produced 700*l.* a year to the duke of Corigliano. The banks of the Sinno are famous in Roman history for the victory gained by Pyrrhus over the consul Levinus, in the year of Rome 473. This is said to have been the first encounter of the Epirots with the Romans. The honour of the day was purchased by Pyrrhus at the expence of the flower of his army.

SINO, a town of Africa, on the Grain Coast; 30 miles S.E. of Sanguin.

SINOBO, or SINOPE, a sea-port town of Asiatic Turkey, in the sangiacat of Kiutaja, near the coast of the Black sea, on the isthmus of a peninsula, six miles in circumference, which terminates in a considerable cape, which has not above twelve feet of water. The antiquity of this town is traced to the time of the Argonauts, or at least to the time when the Cimmerians established themselves here; for being driven from their country by the Scythians, they came into Asia, over against the mouth of the Ister. Its first commencement, however, was feeble; but when it received a colony of Milesians, it rose to such a degree of power, that it founded other colonies on the coasts of the Euxine sea, whilst it possessed all the advantages of liberty. It was taken by Pharnaces, father of Mithridates, and made the capital of Pontus; and it became the birth-place of Mithridates. In the year B.C. 70, it was taken by the Romans under Lucullus, who restored its liberty. After experiencing a variety of calamities under the tyranny of Pharnaces, Julius Cæsar, having vanquished this prince, re-established Sinope, and sent hither a Roman colony. It established a new era in commemoration of this happy event, and inscribed on its monuments the title of "Colonia Julia Felix Sinope." This colony was sent to Sinope in the year of Rome 709. The town subsisted in a flourishing state under the Roman emperors. Its commerce, which was considerable, and the convenience of its ports, contributed alike to its opulence and its splendour. Strabo says that it was one of the most considerable towns of Asia. A particular worship was paid to Serapis at Sinope, and it also honoured Mercury as the god of commerce. Strabo and Pliny say, that Sinope, under the Roman emperors, comprised in Paphlagonia, formed a part of the government of Bithynia. Paphlagonia, however, was detached from Bithynia, and formed a particular province, about the reign of Constantine; but the town of Sinope was united with some other towns of Pontus, to form the province of Hellepont, in honour of Helena, the mother of Constantine.

tine. When the emperor Heraclius divided the East into several departments, the town of Sinope was included in that of Armenia. Christianity was received in this city towards the end of the third century. This place has two good harbours, and a dock-yard for building ships. Turks only reside within the walls; one of the fauxbourgs is inhabited by Greeks, with a metropolitan dependant on the patriarch of Constantinople. In the environs are some copper-mines. Diogenes, the cynic, was a native of Sinope, but he was buried at Corinth; 380 miles E. of Constantinople. N. lat. $41^{\circ} 6'$. E. long. 35° .

SINON, a river of Persia, in the province of Mazanderan, which runs into the Caspian sea, 5 miles E. of Fehrabad.

SINONGI, a town of Japan, in the island of Ximo; 20 miles S.W. of Sanga.

SI NON OMNES, in *Law*, a writ on affocation of justices, by which, if all in commission cannot meet at the day assigned, it is permitted that two or more of them may finish the business.

SINOOTS, in *Geography*, a town of Japan, in the island of Ximo; 20 miles E. of Taifero.

SINOPE, in *Ancient Geography*. See SINOB.

SINOPE, a river of Asia, in Paphlagonia, which runs near the town of Sinope.

SINOPER, or SINOPIS, in *Natural History*. See SINOPICA Terra.

SINOPICA TERRA, the name of a red earth, of the ochre-kind, called also *rubrica sinopica*, and by some authors *sinopis*.

It is a very close, compact, and weighty earth, of a fine glowing purple colour, but in some specimens much deeper than in others, and in some degenerates into paleness; but, even in its worst condition, the colour is very fine. It is of a pure texture, but not very hard, and of an even but dusty surface. It adheres firmly to the tongue, is perfectly fine and smooth to the touch, does not crumble easily between the fingers, and stains the hands. It melts very slowly in the mouth, and is perfectly pure and fine, and of a very austere astringent taste, and ferments very violently with aqua fortis. In the fire it acquires a great hardness, but does not change colour.

It was dug in Cappadocia, and carried for sale to the city Sinope, whence it had its name. It is now found in plenty in the New Jerseys, in America, and is called by the people there *blood-stone*, from its staining the hands to a blood-colour, and may probably be had in many other places; and this deserves thoroughly inquiring into, since there seems not one among the earths more worthy of notice. Its fine texture and body, with its high florid colour, must make it very valuable to painters, and its powerfully astringency equally so in medicine.

The ancients were well acquainted with it in fluxes and hæmorrhages, and experience shews it possesses the same virtues at this time. The deepest coloured is ever the most astringent. Hill's Hist. of Foss. p. 60.

SINOPLE, or SENOPLE, in *Heraldry*, denotes *vert*, or the green colour in armories; thus called by the ancient heralds: though Pliny and Isidore, by *color sinopicus*, or *sinople*, mean a brownish-red, such as that of our ruddle.

F. Menestrier derives the word from the Greek *prafina bopla*, *green armories*; by corruptedly retrenching the first syllable *pra*; which is no new thing among Oriental words, witness Salonica for Thessalonica.

Sinople is supposed to signify love, youth, beauty, rejoicing, and liberty: whence it is, that letters of grace,

abolition, legitimation, &c. are always to be sealed with green wax.

SINOPOLI, in *Geography*, a town of Naples, in Calabria Ultra; 5 miles S.W. of Oppido.

SINOTIUM, in *Ancient Geography*, a town of Illyria, in Dalmatia, and one of the fifty possessed by the Dalmatians. Strabo says, that it was reduced to ashes by Augustus.

SINOVIA. See SYNOVIA.

SIN-PING, in *Geography*, a town of China, of the third rank, in Yun-nan; 35 miles N. of Yuen-kiang.

SINSACATA, a town of South America, in the province of Cordova; 36 miles N. of Cordova.

SIN-SI, a town of Corea; 30 miles N.N.E. of Kingki-tao.

SINSJA, a river of Asia, which runs into the Euphrates, 33 miles S.E. of Semifat.

SINSILIN, a town of Persia, in the province of Ghilan; 23 miles W.N.W. of Reshd.

SINSIN, a town of Persia, in the province of Irak; 120 miles N. of Isfahan. See ZINJAN.

SINSO, a province of Africa, in the kingdom of Angola, north of Loanda.

SIN-TAI, a town of China, of the third rank, in Chan-tong; 37 miles S.E. of Tai-nghan.

SIN-TAI-TOUKA, a town of Chinese Tartary. N. lat. $41^{\circ} 16'$. E. long. $120^{\circ} 14'$.

SIN-TAN, a town of China, of the third rank, in Setchuen; 10 miles S.S.E. of Han.

SIN-TCHANG, a town of Corea; 45 miles E. of Haimen.—Also, a town of China, of the third rank, in Kiang-si; 37 miles W.S.W. of Choui-tcheou.—Also, a town of China, of the third rank, in Tche-kiang; 42 miles N.N.W. of Tai-tcheou.—Also, a city of China, of the second rank, in Yun-nan. N. lat. 29° . E. long. $103^{\circ} 29'$.

SIN-TCHEOU, a city of China, of the first rank, in Quang-si. N. lat. $33^{\circ} 26'$. E. long. $109^{\circ} 29'$.

SIN-TCHIM HOTUN, a city of Corea. N. lat. $42^{\circ} 57'$. E. long. $130^{\circ} 18'$.

SIN-TCHIN, a town of China, of the third rank, in Pe-tche-li; 32 miles N.E. of Pao-ting.—Also, a town of China, of the third rank, in Chan-tong; 30 miles N.W. of Tcin-tcheou.

SIN-TCHING, a town of China, of the third rank, in Kiang-si; 22 miles S.S.E. of Kien-tchang.—Also, a town of China, of the third rank, in Tche-kiang; 30 miles N.N.E. of Yen-tcheou.—Also, a town of China, of the third rank, in Setchuen; 17 miles E. of Xun.—Also, a town of China, of the third rank, in Ho-nan; 20 miles N. of Hiu-tcheou.

SIN-TCHU-AM, a town of Chinese Tartary. N. lat. $41^{\circ} 5'$. E. long. $120^{\circ} 54'$.

SIN-TCHUEN, a town of Corea; 48 miles S.W. of Hoang-tcheou.

SIN-TCIN, a town of China, of the third rank, in Hou-quang; 20 miles W.S.W. of Koue-yang.

SINTHUS, in *Ancient Geography*, a town of Macedonia, in the Amphaxitide, near the gulf Thermæus, according to Herodotus.—Also, one of the largest rivers which discharged themselves into the Erythræan sea. Arrian.—Also, one of the mouths of the Indus, according to Ptolemy.

SIN-TIEN, in *Geography*, a city of China, of the second rank, in Yun-nan. N. lat. $25^{\circ} 36'$. E. long. $102^{\circ} 54'$.

SIN-TIENTSE, a town of Chinese Tartary. N. lat. $41^{\circ} 16'$. E. long. $121^{\circ} 19'$.

SINTII, in *Ancient Geography*, the name of a people

who inhabited the isle of Lemnos, according to Homer. This name, however, probably belongs to the inhabitants of the town of Sindus, or Sinthus, near the Thermaic gulf.

SINTQUIPAQUE, in *Geography*, a town of Mexico, in the province of Guadalajara, on the Barania; 110 miles N.W. of Guadalajara.

SIN-TOU, a town of China, of the third rank, in Kiang-si, on the river Kan; 13 miles S. of Lin-kiang.—Also, a town of China, of the third rank, in Se-tchuen; 10 miles S. of Han.

SINTRA. See **CINTRA**.

SIN-TSAI, a town of China, of the third rank, in Honan, on the river Yu; 32 miles E.S.E. of Yun-hing.

SINTZHEIM, a town of the duchy of Baden; 13 miles S.S.E. of Heidelberg.

SINU. See **ZINU**.

SINUATUM FOLIUM, in *Botany*, a Sinuated Leaf, so called from *sinus*, a bay or creek, in allusion to its winding outline, or the broad, deep, rounded incisions of its margin. See **LEAF**.

SINUESSA, in *Ancient Geography*, a town of Italy, on the frontiers of Latium and Campania, near the marsh of Miltunes. It derived its name, according to Strabo, from the sinuosity of the coast, which at this place formed a small gulf. Some remains of it, as well as of its baths, the water of which was reputed to be excellent against sterility, still subsist. Sinuessā was a Roman colony, according to Livy.

SINUNIA, a town of Asia, in Parthia, according to Ptolemy.

SINUOSITY, a series of bends and turns in arches, or other irregular figures; sometimes jetting out, and sometimes falling in: such as described by the motion of a serpent, &c.

It is the sinuosity of the sea-coasts that forms bays, ports, capes, &c. Du Loir observes, that the course of the river Meander, creeping in a thousand agreeable sinuosities, served Dædalus as a model by which to form his labyrinth.

SINUOUS ULCERS. See **ULCER**.

SINUS, in *Anatomy*, a term applied to various cavities of the body. In the head we have the sinuses of the frontal, sphenoid, ethmoid, and maxillary bones; which are cavities of these bones communicating with the nose. (See **CRAanium** and **NOSE**.) The sinuses of the dura mater are the large veins of the brain. (See **BRAIN**, **NERVOUS System**, and **VEIN**.) The sinuses of the venæ and cavæ and pulmonary veins are the principal parts of the two auricles. (See **HEART**.) The sinus of the vena portarum is its trunk, just before it divides into the right and left branches. See **VEIN**.

SINUS, in *Surgery*, a small orifice leading down to an abscess.

SINUS Hipponensis, in *Ancient Geography*, the gulf of Bizerta, a gulf of Africa, formed by the promontory "Candidum" to the north-west, and the promontory "Apollinis" to the east.

SINUS Numidicus, the gulf of Stora, a gulf of Africa, formed to the west by the promontory "Tritum," and to the east by the promontory "Tapfus."

SIN-YAN, in *Geography*, a river of China, which runs into the Eastern sea, 17 miles E.N.E. of Yen-te-hing.

SIN-YANG, a town of Corea; 45 miles S. of Koang-tcheou.—Also, a city of China, of the second rank, in Honan. N. lat. 32° 12'. E. long. 113° 38'.

SIN-YE, a town of China, of the third rank, in Honan; 27 miles S.S.W. of Nan-yang.

SIN-YU, a town of China, of the third rank, in Kiang-si; 25 miles W.S.W. of Lin-kiang.

SINZIG. See **ZINZIG**.

SINZITA, in *Ancient Geography*, a town of Lesser Armenia, in the prefecture of Muriana. Ptolemy.

SIO, in *Geography*, a river of Hungary, which runs into the Sarand, near Simontornya.—Also, a river of Spain, which runs into the Segra, a little above Balaguer.—Also, a decayed town of Africa, on the coast of Zanguebar; 10 miles N.W. of Ampaça.

SIOCON, a town on the west coast of the island of Mindanao. N. lat. 7° 25'. E. long. 122° 12'.

SIOCOTTICLAY, a town of the island of Ceylon; 25 miles N.N.W. of Trincomaly.

SIODA, in *Ancient Geography*, a town of Albania, being one of those which Ptolemy places between the Cyrrhus and Albanus.

SIOE, in *Geography*, a small island of Denmark, near the W. coast of Langeland. N. lat. 54° 58'. E. long. 10° 42'.

SION, or **ZION**, in *Ancient Geography*, a mountain of Palestine, or of the land of Canaan, for an account of which, see **JERUSALEM**.

SION was also one of the names of mount Hermon, or rather of a chain of mountains, called mountains of Hermon, from mount Hermon, the principal of them. Of this mountain the Psalmist probably speaks in Ps. cxxviii. 3.—Also, a town of Palestine, in the tribe of Issachar, according to the book of Joshua.

SION, in *Geography*, a town of France, in the department of the Lower Loire; 9 miles W. of Chateaubriant.

SION, or **Sitten**, a town of Switzerland, and capital of the Vallais, situated on a river of the same name, which soon after runs into the Rhone. This is the see of a bishop, the most ancient in Switzerland, and said to have been originally founded at Martinach. The bishop, who styles himself count and vogt-governor of the Vallais, is elected by the chapter of the cathedral and the representatives of the tythings, and is a suffragan of the archbishop of Moutiers, in Savoy. It contains six churches, with some convents, a college, and three palaces of the bishop, standing one above another; 48 miles E. of Geneva. Sion is situated at the foot of three insulated rocks, that rise immediately from the plain. The highest, called Tourbillon, supports the ruins of the old episcopal palace, containing two or three untenanted apartments, in one of which are the portraits of the several bishops. On the second rock, denominated Valeria, are observed the remains of the old cathedral, and a few houses belonging to the canons. On Mayoria, the third rock, stands the episcopal palace, an ancient edifice of stone, built in 1547. Two apartments in this palace deserve attention. The first is that in which the diet assembles; and the other is the hall, in which the bishop holds his court, like the feudal lords of ancient times; at the further extremity is a raised seat, called a throne, surrounded by a wooden balustrade, and as an incitement to wisdom and impartiality, the figures of Justice and Solomon's judgment are coarsely painted upon the walls. Sion is an ancient town, and was formerly the capital of the Seduni, who inhabited this part of the country in the time of Julius Cæsar. Among several obliterated inscriptions, one is legible, in honour of the emperor Augustus, during his eleventh consulship. In this inscription the town is called "Civitas Sedunorum." N. lat. 46° 11'. E. long. 7° 9'. See **VALLAIS**.

SION College. See **COLLEGE**.

SIONDEIAR, in *Geography*, a town of Hindoostan, in the Carnatic; 25 miles N.W. of Ongole.

SIONDY,

SIONDY, a town of Hindoostan, in the Carnatic; 20 miles S. of Ongole.

SIONE, a river of America, which runs into lake Erie, N. lat. $42^{\circ} 22'$. W. long. $82^{\circ} 52'$.

SIONI, a town of Georgia, in the province of Carduel; 90 miles N.N.W. of Teflis.

SIOPE, a river of Brazil, which runs into the Atlantic, S. lat. $3^{\circ} 20'$. W. long. $40'$.

SIORING, a town of North Jutland; 4 miles N.W. of Titled.

SIOTO. See SCIOTO.

SIOTOSTA, a town of Sweden, in West Gothland; 49 miles E.S.E. of Gotheborg.

SIOUEN, a town of China, of the third rank, in Quang-tong; 32 miles S. of Louy.

SIOULE, a river of France, which runs into the Allier, two miles N. of St. Pourçain, in the department of the Allier.

SIOU-OUEN, a town of China, of the third rank, in Koei-tcheou; 15 miles N.N.W. of Koei-yang.

SIOUX, a river of Louifiana, which runs into the Mississippi, N. lat. $38^{\circ} 42'$. W. long. $93^{\circ} 17'$.

SIOUX, a denomination that distinguishes Indians of North America, who inhabit the territories about the rivers Mississippi and Missouri. The dread of this powerful nation is extended over all the other savage nations, from the confluence of the Mississippi and Missouri, to the Raven river on the former, and to the Snake Indians on the latter. Among these nations, however, the Sioux have many allies; but the Chippeways are an exception, as they have maintained with them a long contest; and, indeed, by means of their small lakes, water-courses, and impenetrable morasses and swamps, they bid defiance to the attacks of their neighbours. Of the Sioux nation there are different bands, that are distinguished among themselves. The first of these comprehends the Minowa Kantong, or Gens de Lac, who extend from the Prairie des Chiens to Le Prairie du François, 35 miles up the St. Peters. This band is again subdivided into four classes, under different chiefs. The first subdivision hunts on both sides of the Mississippi and its confluent streams, from the Prairie des Chiens to the river Du Bœuf. The second subdivision resides near the head of the lake Pepin, and hunts from the Rivière du Bœuf near to the river St. Croix. The third subdivision resides between the Rivière au Canon and the entrance of the St. Peters. Its principal hunting ground is on the St. Croix. The fourth subdivision is situated from the entrance of St. Peters to the Prairie des François; they have a village nine miles up the St. Peters, on the N. side. The band Minowa Kantong is reputed the bravest of all the Sioux. The second band of Sioux includes the Washpetong, or Gens des Feuilles, who inhabit the country from the Prairie des François near to Roche Blanche, on the St. Peters. They hunt on the St. Peters, and also in the Mississippi up Rum river, and sometimes follow the buffalo over the plains. The third band comprises the Sussitongs, who extend from the Roche Blanche to Lac de Gros Roche, on the river St. Peters. They are subdivided into the Cawrees and Sussitongs proper, both of whom hunt E. of the Mississippi, and up that river, as far as the Rivière de Corbeau. The fourth great band comprehends the Yanc-tongs, who are dispersed from the Montaignes de la Prairie, which extend from St. Peters to the Missouri, to the river De Moyen. These are subdivided into the Yanc-tongs of the north and those of the south. These are the most unsettled and erratic of all the Sioux; so that they are sometimes found on the borders of the Lower Red river, sometimes on the Missouri, and on those immense plains that lie be-

tween the two rivers. The fifth band includes the Titongs, who are dispersed on both sides of the Missouri. The sixth and smallest band of the Sioux includes the Washpetoute, who reside generally on the lands west of the Mississippi, between that river and the Missouri. They generally hunt on the head of the river De Moyen. These are represented as the most stupid and inactive of all the Sioux.

The Minowa Kantongs are the only Sioux who use canoes, and they are by far the most civilized; being the only Sioux who have ever built log huts, or cultivated any species of vegetables. This band is entirely armed with firearms. The Washpetong are a roving band; they leave the river St. Peters in April, and do not return from the plains until the middle of August. The Sussitongs of Roelic Blanche bear the character of being the most evil-disposed Indians on the river St. Peters. They likewise follow the buffalo in the spring and summer months. The Sussitongs of the Lac de Gros Roche bear the character of good hunters and brave warriors. The Yanc-tongs and Titongs are the most independent Indians; as they follow the buffalo where chance directs; clothing themselves with the skin, and making their lodges, bridles, and saddles of the same materials, the flesh of the animal furnishing them with food.

The claims of limits of the Sioux nation are allowed by all their neighbours to commence at the Prairie des Chiens, and to ascend the Mississippi, on both sides, to the Rivière de Corbeau, up the river to its source; from thence to the source of St. Peters; from thence to the Montaigne de la Prairie; from thence to the Missouri, down that river to the Mahas, bearing thence N.E. to the source of the river De Moyen; and from thence to the place of commencement. They also claim a large territory S. of the Missouri. The country E. of the Mississippi, from Rum river to the Rivière de Corbeau, is likewise in dispute between them and the Chippeways, and has been the scene of many sharp encounters for near 150 years past.

The Sioux are represented as the most warlike and independent nation of Indians within the boundaries of the United States, every passion being subservient to that of war; and their leaders feel themselves perfectly secure from any combination that can be made against them. Their guttural pronunciation, high cheek-bones, thin visages, and distinct manners, together with their own traditions, supported by the testimony of neighbouring nations, leave little room for doubt, that they have emigrated from the N.W. point of America, to which they had come from the narrow strait which in that quarter divides the two continents, and that they are descendants of a Tartarian tribe. Pike's Account of Expeditions to the Sources of the Mississippi, &c. Appendix to part 1.

SIPA, a town of Napaul; 98 miles N.E. of Catmandu.

SIPALAY, a town on the W. coast of the island of Negroes. N. lat. $9^{\circ} 43'$. E. long. $122^{\circ} 28'$.

SIPANEA, in *Botany*, Aubl. Guian. 147. t. 56, a name of Aublet's, whose origin or meaning does not appear. The plant is supposed by Jussieu to be a congener of *Mussaenda*; but Schreber more justly refers it to *VIRECTA*, Linn. Suppl. 17. See that article hereafter.

SIPARUNA, Aubl. Guian. 864. t. 333. Juss. 443, an unexplained name for a shrub of Guiana, whose generic characters are not sufficiently made out to allow of its being reduced by Jussieu to any of his natural orders; nor has Schreber admitted it into his *Genera Plantarum*. Aublet refers it to the *Monocia Decandria* of the Linnæan system.

Gen. Ch. Male, *Cal.* Perianth of one leaf, in four deep roundish segments. *Cor.* none. *Stam.* Filaments four, six, eight, or ten, inserted into a hairy receptacle; anthers of two cells. *Pist.* none.

Female, *Cal.* and *Cor.* as in the male. *Stam.* none. *Pist.* Germen superior, roundish; style oblong, striated; stigmas five, capillary. *Fruit* unknown.

1. *S. guianensis*.—Found on the borders of rivulets, in the quarter of Oyac, flowering in August. The stem is eight or ten feet high, slender, with long, slender, smooth, opposite branches; its wood white and brittle. *Leaves* elliptic-oblong, smooth, pointed, entire, about five inches in length, opposite, on short stalks. The flowers are axillary, green, very small, on short, somewhat racemose, stalks.

SIPAVEND, in *Geography*, a town of Persia, in the province of Mekran; 212 miles N.N.W. of Kidge.

SIPELER, a town of Hindoostan, in the circar of Condapilly; 24 miles S. of Masulipatam.

SIPGICON-COUTEN, a town of Chinese Tartary, in the country of Hami. N. lat. 40° 10'. E. long. 95° 42'.

SIPHAC, a name used by some authors for the peritomeum.

SIPHANTO, in *Geography*, an island of the Archipelago, N. of Argentiera, and very close to it. In former times this island was flourishing under the name of "Siphnos," and it was even reckoned the richest of the Archipelago, on account of the gold and silver-mines which had there been discovered, and of which the tenth alone furnished the temple of Apollo at Delphos with the richest treasure that had been seen. These mines reflect dishonour on the memory of the Siphnians, whilst they enriched them; for their opulence produced such a corruption of morals and duplicity of character, which became so common and so characteristic of them, that they served, throughout all Greece, as a term of comparison, when it was required to paint discredited morals or perfidy of conduct. At this day, the treasures concealed within the bosom of the earth are unknown; and the discovery of them remains to become a source of riches to an island, which, though less impoverished than some others, exhibits in a degree the picture of misery common to all these countries. Besides the mines of gold and silver which Siphanto afforded, it has some that are very abundant in lead, iron, and load-stone. Its mountains also contain quarries of very beautiful marble, and the residents speak of a species of very soft stone, with which they made vases that were conveyed throughout all Greece, but are not known in our days; so that the island of Siphanto would still be the richest of the Archipelago, if it ceased to be subject to a government which crushes it with an iron hand. It is also one of the most agreeable and most cheerful; the air is pure and wholesome; the plains are adorned with a variety of dress, which it owes to easy labour; and the excellent quality of their productions is another precious favour of nature. Salt, cotton, figs, oil, wax, and a few other commodities of less importance, compose the crops and the trade of the island: but both might be much augmented by industry, if it were encouraged. Fine cotton-cloths, straw-hats, &c. are manufactured here. The inhabitants are mild and hospitable; the women are beautiful; but their dress disguises their charms. This island has no harbour, except for small vessels. The most considerable place, which is called Scrai, is built on steep rocks, which leave below the town only a small cave, where boats can anchor, because if they were surpris'd here by a northerly wind, they would soon be dashed to pieces on the coast; those of the country are hastily drawn on

shore as soon as they are unloaded. Siphanto contains five villages, and about 5000 inhabitants. N. lat. 36° 59'. E. long. 24° 56'.

SIPHILIS, from *σιφλος*, *filthy*, in *Surgery*, the venereal disease. See LUES *Veneræ*.

SIPHITA, a word used by Paracelsus, and his followers, with the addition of *parva* and *magna*, for two disorders. The *siphita parva* signifies the *chorea sancti Viti*, or *St. Vitus's dance*; and the *siphita magna*, walking in time of sleep.

SIPHNIUS LAPIS, in the *Natural History* of the ancients, a substance found in great plenty in the island Siphnos, (*Siphanto*), in the *Ægean* sea. It was dug up in large masses in the neighbourhood of the sea; and when fresh, might be cut or worked into any sorts of vessels, by reason of its softness; but when afterwards burnt and oiled over, became black and solid, and fit for any service: and the vessels made of it bore the fire very well. The same substance is still found in many parts of Europe, and called *lapis lebitum*, and applied to the same use. It is no other than the steatites, or our soap-rock.

SIPHON, or *ΣΥΦΩΝ*, in *Hydraulics*, a crooked tube, one leg or branch of which is longer than the other; used in the raising of fluids, emptying of vessels, and in various hydrostatical experiments.

The word in the original Greek, *σιφών*, signifies simply *tube*, whence some apply it to common tubes or pipes. Wolfius particularly describes two vessels under the name of siphons: the one cylindrical in the middle, and conical at the two extremes; the other globular in the middle, with two narrow tubes fitted to it axis-wise: both serving to take up a quantity of water, &c. and to retain it when up.

But the most useful and celebrated siphon is that which follows: a crooked tube ABC (*Plate XV. Hydraulics, fig. 1.*) is provided of such a length, and with such an angle, or so bent at the vertex, as that when the orifice A is placed on an horizontal plane, the height of AB may not exceed thirty-two or thirty-three feet. For common uses, a foot or half a foot high suffices. If, now, the left arm, AB, be immersed in water, or any other liquid, and the air be sucked out of it by the aperture C, till the liquor follow; the liquor will continue to flow out of the vessel, through the tube BC, as long as the aperture A is under the surface of the liquor.

Note, instead of sucking out the air, the event will be the same, if the siphon be at first filled with the fluid, and the aperture C lopped with the finger, till the aperture A be immersed.

The truth of the phenomenon is known by abundance of experiments; nor is the reason of part of it far to seek. In sucking, the air in the tube is rarefied, and the equilibrium destroyed; consequently the water must be raised into the taller leg AB, by the preponderating pressure of the atmosphere.

The siphon being thus filled, the atmosphere presses equally on each extremity, so as to sustain an equal quantity of water in each leg; but the air not being able to sustain all the water in the longer leg, and being more than able to sustain that in the shorter leg; with the excess of force, therefore, it will raise new water into the shorter leg; and this new water cannot make its way, but by protruding the first before it: by this means is the water continually driven out at the longer leg, as it is continually raised by the shorter.

The cause of the siphon's running may be otherwise explained in the following manner: the air which passes into the vessel ABCD (*fig. 2.*), represented by the column

K L, sustains the column of water, L D, in the short leg of the siphon, pressing against that air with its perpendicular height D F; whilst the column of air M S, pressing upwards against the whole of the long or issuing leg D S, which acts according to the height D C, must yield and suffer the water to run out, as long as the leg D S is longer, or rather perpendicularly higher, than D G. For since K and M are supposed to be at the top of the atmosphere, the columns K L and M S are equal in height and pressure, (for the height of L above S is of no account with respect to the whole height of the atmosphere,) as long as M S is acted upon by the descending water D S, whose height is from D to S, (*e. g.* fifteen inches,) an height superior to that of the column D G, (*e. g.* seven inches,) supported by the column of air K L, the column M S must yield to the water issuing out at S; and however the surface of the water, E F, descends, the column K L, by its pressure, will always overcome the resistance of the column M S, because it has a less height of water to sustain than M S has. If the mouth of the issuing leg had been at T, the water would hang *in equilibrio*, filling both legs of the siphon, when the water is come down in the upper vessel to I H T; because then the two columns of air, K L and M S, will be acted against by an equal height of water in the legs of the siphon; but if you raise the issuing end of the siphon (now supposed at T) up to the level of *v* V above I H, the water will run back up from V to D, and so out at H in the upper vessel; because then the column M S, having only the height V D to sustain, will be acted against with less force than the column K L, which is pressed against by the whole height, D H, superior to V D. Since, therefore, the pressure of the air is the cause of the water being pushed up into the siphon, and the difference of its pressure (as one column is acted against by the water in the short leg more weakly than another column of air is acted upon by the water in the long leg) is the cause of its running continually from one vessel into another, when once set a-going; it follows, that the bend, D, of the upper part of the siphon must not be above thirty-two feet higher than the water in the upper vessel, because the air cannot sustain a column of water, whose height exceeds thirty-two feet.

Mercury will run in a siphon in the same manner as water; but in this case, the bend of the siphon must not be more than $30\frac{2}{3}$ inches above the stagnant mercury in the upper vessel; because, as it is about fourteen times specifically heavier than water, it will be lifted up by the pressure of air but the fourteenth part of the height to which the water is lifted. Defag. Exp. Phil. vol. ii. sect. 8.

But some authors assert, that the water continues to flow through the siphon, even when placed under a receiver, and the air exhausted from it.

Some will have it, that there is still air enough left in the evacuated receiver, to raise the water to an inch or two. But as both mercury and water are found to fall entirely out of the Toricellian tube, *in vacuo*; the pressure of the thin remaining air there can never be the cause of the ascent, both of mercury and water, in the shorter leg of the siphon. Hence, as the height of the siphon is limited to thirty-two feet; for this only reason, that air cannot raise water higher; some have questioned whether or not we are in the right in rejecting Hero's method of carrying water, by means of a siphon, over the tops of mountains, into an opposite valley. For Hero only orders the apertures of the siphon to be stopped, and water to be poured through a funnel into the angle or meeting of the legs, till the siphon be full; when, shutting the aperture in the angle, and opening the other two, the water, he says, will continue to

flow. Now, if there only need air for the first rise of the water into the legs, not for the continuation of the motion, it were possible to raise the water much higher than the height of the atmosphere would carry it.

Wolfius (*Elem. Mathes. tom. ii. p. 348. ed. 1733.*) expressly says, that this proposed artifice of Hero is very justly rejected; because air is necessary not only for the elevation of the water in the shorter leg, but for the continuance of its motion; and he adds, that this method was unsuccessfully tried, where the height was greater than thirty-two feet.

Defaguliers also observes, that in a crane or siphon, such as that proposed by Hero, of about forty feet high, the water, instead of running from the upper vessel into the lower, as it would do if the height of the short leg were much under thirty-two feet, will in the two legs fall back to the height of thirty-two feet, above the respective vessels, where it will hang; the air not being able to sustain the water above these heights, and consequently drive it up over the bend.

In an experiment of this kind, the water in the legs of the siphon, unless it be purged of its air, will not rest at a height of quite thirty feet above the water in the vessels, because air will extricate itself out of the water, and getting above the water in the legs, presses it downwards, so that its height will be less to balance the pressure of the atmosphere. However, this is certain, that a siphon of a particular kind, once set a running, will persist in its motion, though removed into the most perfect vacuum our air-pumps will make: or, if the lower orifice of a full siphon be shut, and the whole be thus placed in a receiver, with a contrivance for opening the orifice when the air is exhausted; the water will be all emptied out of the vessel, as if it had been in the open air.

This fact has been sufficiently ascertained by many approved hydrostatical writers.

Defaguliers informs us, that he made the experiment, both with water and mercury; for having filled a siphon, recurved at the extremities of its legs, successively with those liquors, and suspended it by a slip-wire in the receiver of an air-pump, over two small jars containing mercury to unequal heights, (and water, when water was used in the siphon,) he exhausted the air out of the receiver, and then letting down the siphon, so that its two ends went into the liquor in the jars, the liquor ran from the higher into the lower vessel. He also made an experiment in the open air, where the mercury ran through a siphon, whose bend was more than thirty-one inches above the lower orifice of the short leg of the siphon. But neither of these experiments affords a just objection against the doctrine advanced in the preceding part of this article, *viz.* that the air is the cause of the discharge of liquors from one vessel into another by means of siphons; for its running *in vacuo* was only owing to the attraction of cohesion, which acts for a small height; because the experiment will not succeed *in vacuo*, if the siphon used for mercury has its bend six inches higher than the orifice of the short leg, and if the bend of the siphon for water be two or three feet high; neither will the last-mentioned experiment with mercury in the open air answer, if the bend of the siphon be forty inches high: and in all the experiments, the bores of the siphons must be very small. Exp. Phil. ubi supra, p. 168.

The figure of the siphon may be varied at pleasure (see *figs. 3, 4, 5.*), provided only the orifice C be below the level of the surface of the water to be drawn up; but still the farther it is distant from it, the faster will the fluid be carried off. And if, in the course of the flux, the orifice A

be drawn out of the fluid, all the liquor in the siphon will go out at the lower orifice C; that in the leg C B dragging, as it were, that in the shorter leg A B after it.

If a filled siphon be so disposed, as that both orifices, A and C, be in the same horizontal line, the fluid will remain pendant in each leg, how unequal soever the length of the legs may be. Fluids, therefore, in siphons, seem, as it were, to form one continued body; so that the heavier part, descending like a chain, pulls the lighter after it.

Lastly, it must be observed, that the water will flow out, even through a siphon that is interrupted, by having the legs A D and F C joined (fig. 5.) together, by a much bigger tube full of air.

The siphon Wirtembergicus is a very extraordinary machine of this kind, performing divers things which the common siphon will not reach. *E. gr.* In this, though the legs be in the same level, yet the water rises up the one, and descends through the other; the water rises, even though the aperture of the less leg be only half immersed in water; the siphon has its effect after continuing dry a long time; either of the apertures being open, the other remaining shut for a whole day, and then opened, the waters flow out as usual. Lastly, the water rises and falls indifferently through either leg.

Muschenbroeck, in accounting for the operation of this siphon, observes, no discharge could be made by it, unless the water applied to either leg cause the one to be shorter, and the other longer by its own weight. *Introd. ad Phil. Nat. tom. ii. p. 853. ed. 4to. 1762.*

The project of this siphon was laid by Jordanus Pelletier, and executed at the expence of prince Frederic Charles, administrator of Wirtemberg, by his mathematician Shachard, who made each branch twenty feet long, and set them eighteen feet apart; the description of it was published by Reifelius, the duke's physician.

This gave occasion to M. Papin to invent another, that did the same things, described in the Philosophical Transactions; and which Reifelius, in another paper in the Transactions, ingenuously owns to be the very same with that of Wirtemberg. Its structure will appear from its figure, which is represented *Plate XV. Hydraulics, fig. 6.*

SIPHONANTHUS, in *Botany*, from *σινωον*, a tube, and *ανθος*, a flower, because of the long tube of the corolla. Ammann, the author of the genus, in the Petersburg Transactions, for 1736, called it *Siphonanthemum*.—*Linn. Gen. 53. Schreb. 70. Willd. Sp. Pl. v. 1. 606. Mart. Mill. Dict. v. 4. Juss. 132. Lamarck Illustr. t. 79.—*Class and order, *Tetrandria Monogynia*. *Nat. Ord. Borraginæ affine, Juss.*

Gen. Ch. Cal. Perianth inferior, of one leaf, large, in five deep permanent segments. *Cor.* of one petal, funnel-shaped; tube thread-shaped, very slender, many times longer than the calyx; limb in four deep spreading segments, smaller than the calyx. *Stam.* Filaments four, longer than the limb of the corolla; anthers oblong, triangular. *Pist.* Germen superior, four-cleft, very short; style thread-shaped, the length of the stamens, recurved at the extremity; stigma simple. *Peric.* Berries four, roundish, within the spreading calyx. *Seeds* solitary, roundish.

Eff. Ch. Corolla of one petal, funnel-shaped, very long, inferior. Berries four, with solitary seeds.

1. *S. indica*. Indian Pipe-flower. *Linn. Sp. Pl. 159. Willd. n. 1. Poiret in Lam. Dict. v. 7. 200.* ("Siphonanthemum falicis folio, flore flavescente; *Amm. Act. Petrop. ann. 1736, 214. t. 15.*" *Lysimachii* species; *Pis. et Bont. Ind. Or. 159?*)—Native of the East Indies? We have seen no specimen, but the figures and descriptions

of this plant represent it as having an herbaceous, simple, leafy stem. *Leaves* alternate, or partly opposite; sometimes three in a whorl, sessile, lanceolate, acute, wavy, entire. *Flower-stalks* axillary and terminal, much shorter than the leaves, three-cleft. *Flowers* thrice as long as their stalks, yellowish.

Willdenow has separated Lamarck's fig. 2. as a distinct species, by the name of *S. angustifolia*; but Lamarck himself in his *Illustr. p. 318*, gives that figure as perhaps only a better representation of the original species. The difference indeed between the stigmas of the two figures is too great to be probable. We should think, with this author, that the figure in Bontius might rather belong to some *Volkameria* or *Clerodendrum*, were it not spoken of as a pot-herb. After all, who can be certain, that the history of *Siphonanthus* is not altogether a blunder, and that the original plant itself is not a *Volkameria*, *Clerodendrum*, or *Ovicida*? *O. mitis*, a species very little known to botanists in general, bears a considerable resemblance to it, though the inflorescence differs materially from what is described in *Siphonanthus*.

SIPHONIA, from *σινωον*, a pipe, alluding to the uses made of the resinous exudation of this tree, so well known under the appellation of elastic gum, or *caoutchouc*.—*Schreb. Gen. 656. Willd. Sp. Pl. v. 4. 567. Mart. Mill. Dict. v. 4. Lamarck Illustr. t. 790. (Hevea; Aubl. Guian. 871.)—*Class and order, *Monocelia Monadelphia*. *Nat. Ord. Tricocca, Linn. Euphorbia, Juss.*

Gen. Ch. Male, Cal. Perianth of one leaf, bell-shaped, rather globose, cut half way down into five erect, acute teeth, reflexed at the margins. *Cor.* none. *Stam.* Filaments united into a column, shorter than the calyx; anthers five, nearly ovate, attached to the column below its summit.

Female, Cal. Perianth inferior, of one leaf, bell-shaped, somewhat turbinate, with five acute, spreading, recurved deciduous teeth, the circular base only being permanent. *Cor.* none. *Pist.* Germen superior, globose, somewhat conical, shorter than the calyx; style none; stigmas three, thickish, depressed, two-lobed. *Peric.* Capsule large, three-lobed, depressed, hollowed out at the base, woody, very hard, of three cells, invested with a fibrous bark; each cell with two elastic valves. *Seeds* one, two, or three, nearly ovate, with a brittle spotted shell.

Eff. Ch. Male, Calyx bell-shaped, five-cleft. *Corolla* none. *Filament* columnar, with five anthers.

Female, Calyx bell-shaped, five-cleft. *Corolla* none. *Stigmas* three, sessile. *Capsule* of three lobes, with elastic valves.

1. *S. elastica*. Elastic-gum Tree. *Martin n. 1. (S. Cahuchu; Richard. Willd. n. 1. Jatropha? elastica; Linn. Suppl. 422. Hevea guianensis; Aubl. Guian. 871. t. 335. "Pao feringa; Mem. de l'Acad. des Sc. for 1751. t. 20, bad.)—*Native of Brazil, and the forests of Guiana, bearing fruit in April and May. A tree, whose trunk rises to the height of 50 or 60 feet, with a thin grey bark, and a soft white wood; the branches spreading widely in every direction. *Leaves* towards the ends of the branches, alternate, but crowded, and spreading in a circular order round the branch, on long stalks, ternate; leaflets elliptical, obtuse, entire, or minutely undulated, smooth, reticulated with veins; paler beneath; each about three inches long, and one wide, on a partial stalk about half an inch in length. *Common footstalks* rather longer than the leaflets, round, singly downy. The flowers we have not seen, but they are said to be small, downy, as well as their stalks; the male ones numerous, racemose; the female solitary, at

the end of each cluster. *Fruit* the size of a chestnut in its shell, green, smooth, of three large ovate lobes, the valves bursting elastically, like those of a *Jatropha*. Aublet says the *nuts* are very good and wholesome. The trunk of the tree, when wounded, discharges a milky fluid, which being collected, either in a mass, or by smearing it over lumps of clay, sticks, &c. dries into any shape that is wanted, and becomes the elastic gum, or Indian rubber, so useful to artists for effacing at pleasure the marks of a black-lead pencil. (See CAOUTCHOUC.) We beg leave to correct a slight botanical inaccuracy in that article; for the *Hevea* and the *Jatropha elastica* are precisely the same plants. There is indeed, in the Linnæan herbarium, besides the original specimen, marked with this last name, another from Mutis, which that learned botanist judged to be a distinct species, though affording, as some other trees do, a similar gum. The *leaflets* in this specimen are larger, more acute at each end, and destitute of partial stalks. The *calyx* is nearly half an inch long. The younger Linnæus, in his *Supplementum*, 422, promised to publish something at a future time respecting the various trees that yield an elastic gum, of the same utility as the *Caoutchouc*; but he did not live to execute his design. His reference to the Mem. de l'Académie for 1751, with a censure of the figure, appears to be copied from Aublet.

SIPIAS, in *Geography*, a town of Mingrelia, situated on a river which runs into the Black sea; 100 miles W.N.W. of Teflis.

SIPING, a town of China, of the third rank, in the province of Ho-nan; 30 miles N.N.W. of Yun-hing.

SIPONIMA, in *Botany*. See CIPONIMA, and SYMLOCOS.

SIPSEY, in *Geography*, a river of the state of Georgia, which runs into the Tombigh, N. lat. 32° 22'. W. long. 87° 51'.

SIPTACE, in *Natural History*, the name given by the ancients to a beautiful bird, of which they were very fond, and which was often kept in their houses. Some have conjectured this to be the goldfinch, from the fine yellow they describe about it; but Pliny plainly makes it the parrot; he tells us, among other things, that it imitated the human voice the best of all birds.

SIPUCA, in *Geography*, a town of Peru, in the diocese of La Plata; 60 miles E. of Plata.

SIPUNCULUS, or TUBE-WORM, in *Vermiology*, a genus of the Vermes Intestina class and order, of which the generic character is as follows: Body round, elongated; mouth cylindrical at the end, and narrower than the body; the aperture at the side of the body, and veruciform. There are only two

Species.

* **NIDUS.** The body of this species is covered with a close skin, and globular at the lower end. It is described and figured by Pennant, Barbut, and Martin. It inhabits European seas, under stones; and is about eight inches long. The body is conic, and broader on the fore-part; the mouth is much slenderer than the body, and armed with fleshy, three-pointed papillæ; the aperture is near the upper extremity.

SACCATUS. Body covered with a loose skin, and rounded at the lower end. It inhabits the American and Indian seas. It is shaped like the nidus, except in being enclosed as it were in a loose bag, and in not having the lower end globular.

SIR, or **SIRR,** in *Geography*, a river which rises in the

mountains of Tartary, about 160 miles W. of Cashgar, and runs into the lake of Aral, in N. lat. 45° 10'.

SIR Biby's Island, a small island in Hudson's bay. N. lat. 61° 55'. W. long. 93° 40'.

SIR Charles Hardy's Island, an island in the Southern Pacific ocean, discovered by captain Carteret in 1767. Its extent is considerable, and it appears to be flat, green, and pleasant. S. lat. 4° 38'. E. long. 134° 6'.

SIR Charles Hardy's Islands, a cluster of small islands in the South Pacific ocean, discovered by captain Cook in 1770. S. lat. 11° 55'. W. long. 217°.

SIR Thomas Hay's Point, a cape on the N.W. coast of Portland, one of Queen Charlotte's islands, in the South Pacific ocean. S. lat. 10° 42'. E. long. 165° 14'.

SIR William James's Island. See *St. Sufanna*.

SIR Henry Martin's Island, an island in the Pacific ocean, about 16 leagues in circumference; discovered by lieutenant Hergest, commander of the *Dædalus* store-ship, in the year 1792. The country seemed to be highly cultivated, and was fully inhabited by a civil and friendly race of people, readily inclined to supply whatever refreshments their country afforded. Mr. Hergest's company were induced to entertain this opinion from the hospitable reception they experienced, on landing, from the chiefs, and upwards of 1500 of the natives, who were assembled on the shores of the harbour. On their return to the ship, they found the same harmony subsisting there with the Indians, who had carried off and sold a supply of vegetables and some figs. It is called by the natives Noohëva. S. lat. 8° 51'. E. long. 220°.

SIR Charles Saunders's Island, or *Tapooamānoo*, an island in the Southern Pacific ocean, discovered by captain Wallis in the year 1767. The island is about six miles in length, and has a mountain of considerable height in the centre, which appeared to be fertile. The inhabitants did not appear to be numerous. S. lat. 17° 28'. W. long. 150° 40'.

SIR Thomas Roe's Welcome, a large bay in the north part of Hudson's bay.

SIRA, a name by which some of the chemical writers have called orpiment.

SIRACAUSTUM, a name given by Mesue to a medicine he recommends in acute diseases.

SIRACUSA, in *Geography*. See SYRACUSA.

SIRADIA, a town of the duchy of Warsaw, late capital of a palatinate of Poland, of the same name, situated on the Warta; 100 miles N.N.W. of Cracow. N. lat. 51° 31'. E. long. 18° 45'.

SIRÆUM, a word used by some to express a sweet decoction, whether given in that form, or first inspissated into a sort of rob by evaporation.

SIRAF, in *Geography*, a town of Persia, in the province of Laristan, on the N. coast of the Persian gulf, inhabited by Arabians from the opposite shores; 30 miles S.W. of Lar. N. lat. 26° 44'. E. long. 53° 50'.

SIRAGUAY, a town on the W. coast of the island of Mindanao. N. lat. 7° 15'. E. long. 112° 9'.

SIRAJEPOUR, a town of Hindoostan, in Allahabad; 10 miles E. of Corah. N. lat. 26° 9'. E. long. 80° 58'.

SIRAITINA, a town of Russia, in the country of the Cossacks; 56 miles S. of Arkadinikaia.

SIRAN, a town of France, in the department of the Herault; 15 miles S.W. of St. Pons.

SIRANCAPE, a river of Africa, which runs into the Indian sea, S. lat. 13° 4'.—Also, a town of Africa, in the country of Mozambique, at the mouth of the river of the same name. S. lat. 13° 4'.

SIRANI,

SIRANI, GIOVANNI ANDREA, in *Biography*, a painter of the school of Guido Rheni. He was born at Bologna in 1610, and was a favourite disciple of his master, whose style he imitated with great success. After the death of Guido, he was employed to finish many of his works, left incomplete in different churches, at Bologna; particularly the large picture of St. Brunone, in the Certosini. He usually painted upon a large scale, and with a free pencil, but in general his manner is too strong and dark, like that of Caravaggio. He died in 1670, at the age of 60.

SIRANI, ELIZABETTA, was the daughter of Giovanni Andrea Sirani, and born at Bologna in 1638. She learned the rudiments of the art from her father, but endeavoured to imitate the best style of Guido. At so early a period as her fifteenth year, she had acquired considerable renown for her performances. Her first public work was painted when she was only seventeen. In general she wrought upon a large scale, and in a most finished manner; with a rich and natural tone of colour. Her compositions are tasteful, and the airs of her heads graceful, and noble in character. Her portraits have greatly the air of nature, with an unaffected character of expression and action.

Unhappily, whilst in the enjoyment of the renown justly due to her inestimable talents and amiable qualities, and which had been acquired by unceasing assiduity, her brilliant career was interrupted by poison; by whom administered is not exactly known, though it is supposed by her servant. This melancholy event happened in 1664, when she had only attained her twenty-sixth year; yet such had been her industry, that she had produced, according to Malvasia, from a register of her own keeping, 150 works: the most admired of which were painted for the churches and palaces at Bologna. They are elsewhere scarce.

SIRAN-LOSA, in *Geography*, a lake of Thibet, about 18 miles in circumference, which communicates with lake Tenckiri by means of a river called also "Siran-lofa;" 18 miles W. of lake Tenckiri.

SIRA-OULOSO, a town of Thibet; 15 miles E. of Hami.

SIRAT, AL, in the *Mahometan Theology*, the name of a bridge, which is situated in the midst of hell, finer than a hair and sharper than the edge of a sword; over which those who are admitted into paradise, and who take the right-hand way, and those who are destined to hell-fire, and take the left, are supposed to pass. On account of its form, it is conceived to be very difficult for any one to stand upon it; and therefore most of the Motazalites reject it as a fable, though the orthodox believe it on the authority of their prophet, by whom it is affirmed; and who has likewise declared, that in order to add to the difficulty of this passage, the bridge is beset on each side with briars and hooked thorns, which will, however, be no impediment to the good, for they shall pass with wonderful ease and swiftness, like lightning or the wind, Mohammed and his Moslems leading the way; whereas the wicked, obstructed by the slipperiness and extreme narrowness of the path, the entangling of the thorns, and the extinction of the light, which directed the former to paradise, will soon miss their footing, and fall down headlong into hell, which is gaping beneath them. Koran, c. 18.

SIRATIK, in *Geography*, one of the Foulah states in Africa, next in order to the principal, which lies within Sierra Leona, and of which Teambo is the capital. It borders on the south of the Senegal river, and on the Jaloffs.

SIRAVAN, a town of Persia, in the province of Chuzistan; 48 miles N.N.E. of Susfer.

SIRE, a title of honour in France, now given to the king only, as a mark of sovereignty. In all placets and petitions, epistles, discourses, &c. to the king, he is addressed under the title of *sire*.

Some derive the word from the Latin *herus*, *master*: of which opinion seems Budæus, who, in speaking to king Francis I., always called him *here*, q. d. *master*, or *sire*; others derive it from the Greek *κυριος*, *lord*; of which opinion is Pasquier, who adds, that the ancient Franks gave the same title to God, calling him *beau sire Dieu*: others fetch the word from the Syriac, and maintain it was first given to the merchants who traded in Syria: Menage will have it come from *senior*, *elder*; whence *seigneur*, then *seignor*, and *sire*.

SIRE was likewise anciently used in the same sense with *sieur* and *seigneur*, and applied to barons, gentlemen, and citizens.

SIRÉ, in *Geography*, a province of Abyssinia, about 25 miles broad, and not much more in length, reckoned as part of Tigré. It lost the rank of a province, and was united to Tigré, on account of the misbehaviour of its governor Kasmeti Claudius, in an expedition against the Shangalla, in the reign of Yafous the Great. It is separated from Samen by the river Tacazzé, and reaches from Axum to this river.—Also, a town situated on the brink of a very steep, narrow valley, through which a road lies that is almost impassable. In the midst of the valley runs a brook, bordered with palm-trees. The town of Siré is larger than that of Axum; it is in form of a half-crown fronting the plain, but its greatest breadth is at the west end. All the houses are of clay, and thatched; the roofs are in form of cones, as indeed are all in Abyssinia. Siré is famous for a manufacture of coarse cotton cloths, which pass for current money through all the province of Tigré, and are valued at a drachm, the tenth part of a wakea of gold, or near the value of an imperial dollar each; their breadth is $1\frac{1}{2}$ yard. Besides these, beads, needles, cohol, and incense, at times only, are considered as money. Although Siré is situated in one of the finest countries in the world, it is very subject to putrid fevers of the worst kind, which sweep away 2 number of people daily. N. lat. $14^{\circ} 4' 35''$. E. long. $38^{\circ} 0' 15''$. Bruce's Travels, vol. iii.

SIREN, *σειρην*, in *Antiquity*, *Mermaid*, a name given to a kind of fabulous beings, represented by the moderns as sea-monsters, with women's faces and fishes' tails; but by the ancient poets, &c. as having the upper part human, and the lower like birds; and decked with a plunage of various colours. There are antique representations of them still subsisting, under both these forms. They are said to have been the daughters of Ocean and Amphitrite, and to form a beautiful part of Homer's machinery in the *Odyssey*. Hyginus places their birth among the consequences of the rape of Proserpine. And Ovid makes them daughters of the river Achelous, and one of the Mules.

The three sirens are called *Parthenope*, *Lygea*, and *Lrucosia*. Homer only makes mention of two sirens, and some others reckon five. Virgil places them on rocks, where vessels are in danger of splitting. Pliny makes them inhabit the promontory of Minerva, near the island Caprea. Others fix them in Sicily, near Cape Pelorus.

Claudian says, they inhabited harmonious rocks; that they were charming monsters; and that sailors were wrecked on their rocks without regret, and even expired in raptures: *Dulce malum in pelago siren*.

Pausanias tells us, that the sirens, by the persuasion of Juno, challenged the Muses to a trial of skill in singing; and these, having vanquished them, plucked the golden

feathers from the wings of the sirens, and formed them into crowns, with which they adorned their own heads. This description is, doubtless, founded on a literal explication of the fable, that the sirens were women who inhabited the shores of Sicily; and who, by all the allurements of pleasure, stopped passengers, and made them forget their course.

The name, according to Bochart, who derives it from the Phœnician language, implies a *song-strefs*: and hence, it is probable, that in ancient times there might have been excellent singers, but of corrupt morals, on the coast of Sicily, who, by seducing voyagers, gave rise to this fable. The Argonauts are said to have been diverted from the enchantment of their songs, by the superior strains of Orpheus: Ulysses, however, had great difficulty in securing himself from seduction. Circe prepares him for the conflict, by the picture and precepts described in the *Odyss.* lib. xii. ver. 51.

Some interpreters of the ancient fables will have the number and names of the three sirens to have been taken from the triple pleasure of the senses, wine, love, and music, which are the three most powerful means of seducing men; and hence, so many exhortations to avoid the siren's fatal song.

Probably it was hence that the Greeks fetched their etymology of siren, viz. from *σειρα*, a chain; as if there was no getting free of their enticement.

Others, who do not look for so much mystery in the fable, maintain that the sirens were nothing but certain straits in the sea, where the waves whirling furiously around, seized and swallowed up vessels that approached them too near.

Lastly, others hold the sirens to have been certain shores and promontories, where the winds, by the various reverberations and echoes, cause a kind of harmony that surpriseth and stops passengers. This, probably, might be the origin of the sirens' song, and the occasion of giving the name of sirens to these rocks.

The learned Mr. Bryant says, that the sirens were Cuthite and Canaanitish priests, who had founded temples in Sicily, which were rendered infamous on account of the women who officiated. They were much addicted to cruel rites, so that the shores upon which they resided are described as covered with the bones of men, destroyed by their artifice. *Virgil, Æneid*, lib. i. v. 864.

The ancients represent their songs as so fatally winning, that nobody could withstand their sweetness: all werefoothed with it; though their life was the purchase of the gratification. See *Homer's Odyss.* M. v. 39.

Mr. Bryant observes, that the story of the sirens relates to those people, who with their music used to entice strangers into the purlieus of their temples, and then put them to death. Nor was it music only with which persons were seduced to follow them; the female part of their choirs were maintained for a twofold purpose, both on account of their voices and their beauty. They were accordingly very liberal of their favours, and by these means enticed sea-faring persons, who paid dear for their entertainment. *Analysis of Ancient Mythol.* vol. ii. p. 17, &c.

SIREN, in *Ichthyology*, a name given by Artedi to the sea-monster often described by authors, but either not existing at all, or not so like man as their description makes it. Artedi supposes it to constitute a peculiar genus of the plagiuri or cetaceous fishes. The characters he gives of it are these: it has no pinnated tail; the head, neck, and breast, down to the navel, represent those of the human species; there are only two fins on the whole body, and those stand on the breast.

Bartholin, in his *History of Curiosities*, describes such a fish as this under the name of *Syrene*, and Barchewitz under the name of *homo marinus*. See MERMAID, SEA-Calf, SEA-Cow, and SEA-MAN.

SIREN, in *Natural History*, a genus of the class and order Amphibia Reptilia, of which the generic character is, Body two-footed, tailed, naked; the feet are placed in the manner of arms, and furnished with claws. There is only a single species mentioned by Gmelin, but Dr. Shaw notices three

Species.

LACERTINA. Body eel-shaped; branchiæ ramified. This species stands eminently distinguished in the list of animals, by the ambiguity of its characters, which are such as to have induced the great Linnæus to institute it for a new order of Amphibia, under the title of MEANTES. The genus with which the siren has the nearest affinity is the *lacerta*, or lizard; which see. It resembles the larva, or first state of a lacerta; and it is even still doubtful whether it may not really be such: yet it has never been observed in any other state, having two feet only, without any appearance of a hind pair. The feet are also furnished with claws, whereas the larvæ of the lacertæ are observed to be without claws; the mouth has several rows of small teeth; the body is eel-shaped, but slightly flattened beneath, marked on the sides by several wrinkles, and slightly compressed towards the extremity of the tail, which is edged with a kind of soft skin, or adipose fin; on each side the neck are three ramified branchial processes, resembling, but on a larger scale, those belonging to the larvæ of water-newts, and at the base are the openings into the gills; the eyes are very small, and blue. The general colour of the animal is a deep or blackish-brown, scattered over, especially on the sides, with numerous minute whitish specks. It is frequently found of the length of two feet, or even more. It is a native of North America, and more particularly of South Carolina, where it is not uncommon in muddy and swampy places, living generally under water, but sometimes appearing on dry land. It has a kind of squeaking or singing voice; hence it was distinguished by the name of siren. This curious animal was first discovered and described by Dr. Garden, who resided many years in Carolina, and who gave the utmost attention to the science of natural history, which he enriched by many highly interesting observations, and by the discovery of many new facts. The doctor communicated specimens of the siren to Linnæus, with particulars relative to its history and manners. The great Swedish naturalist, in his letter to Dr. Garden on this subject, declares that nothing had ever exercised his thoughts so much, nor was there any thing he so much desired to know, as the real nature of so extraordinary an animal. Mr. Hunter has given an anatomical description of the siren in the 56th vol. of the *Philosophical Transactions*, to which the reader is referred.

The siren, if thrown on the ground with any degree of violence, will sometimes break in two or three pieces; and in this particular it resembles the *Anguis fragilis*, or slow-worm. It may also be observed, that though in some respects it resembles the larva of the lizard, yet no lizard, of which it may be supposed the larva, has ever yet been discovered in those parts of Carolina where it is most frequent. The species to which it seems most allied is the *Lacerta tegui* in of Linnæus, which is a native of South America.

ANGUINE; Four-footed siren, with eel-shaped body, and ramified branchiæ. This has been denominated the Proteus anguinus by some naturalists, and by others the Austrian siren. This animal is found in a very singular situation,

being an inhabitant of the celebrated romantic lake Zirknitz, in the duchy of Carniola, in Aultria. From this lake the water regularly retires during the summer, by numerous subterranean outlets at the bottom; leaving the ground dry, and fit for pasture, as well as for various kinds of hunting, and other amusements: but in the month of October it again returns with great force, springing out of the passages before mentioned, from a vast depth, till the lake is completely filled. It is situated in a valley, surrounded by rocky and woody mountains, in which are vast caverns, and it is principally supplied by eight rivulets running into it from the adjoining mountainous region. See Phil. Transf. vol. xvi.

This species of firen is extremely rare, and is found in the spring, and towards the decline of summer, in some particular parts of the above-mentioned lake, and measures from ten to twelve or thirteen inches in length, and about three quarters of an inch in diameter. It is entirely of a pale rose-colour, or even nearly white, except the three pair of ramified branchial fins on each side the neck, which are of a bright red or carmine-colour. Its general shape is that of an eel; the body being cylindrical till towards the end of the tail, where it becomes flat, and is attenuated, both above and below, into a kind of fatty fin, scarcely distinguishable from the rest of the tail; the skin is very smooth and even; the head is of a somewhat depressed form, with a lengthened, obtuse, and widish snout, and it has no external eyes; the mouth is moderately wide, and furnished with a row of very minute teeth; the legs are three quarters of an inch long, and the feet of the fore-legs are furnished with three toes, without claws; the feet of the hind-legs have only two toes. The motions of this animal, when taken out of the water, are, in general, extremely slow and languid; as is also the case when kept in a vessel of water; but in its native lake, it is sometimes observed to swim briskly, waving its body in a serpentine direction, not unlike that of a leech. The Anguine firen is figured and very accurately described by Laurenti, in his work entitled "Specimen Medicum, exhibens Synopsis Reptilium." The real nature of the animal is not completely ascertained; some imagining it to be the larva of some species of lizard, while others contend that it is a perfect animal *sui generis*. It is evidently of a predacious nature, feeding on the smaller kind of aquatic animals; since one of them, which was kept alive in a vessel of water, was observed to discharge from its stomach several small shells of the genus *Helix*; and in the stomach of one, which was dissected, were found the head and bones of a small fish. Its voice is a strong hiss, much louder than might be expected from the size of the animal.

Dr. Schreibers, who has most diligently investigated the nature and anatomy of this animal, says, "there can be no doubt that it bears a great affinity to the *S. lacertina*, having both gills and lungs; and therefore it leaves us in equal uncertainty as to its being a perfect animal in itself, or the larva of another animal." It is, however, remarkable, that notwithstanding the most careful researches during many years, and the frequent fishing which takes place in the lakes and caverns of the neighbouring country, at all seasons of the year, no animal has hitherto been found of which it can possibly be supposed the larva."

PISCIFORMIS; Ferruginous-brown firen, spotted with black, with finely ramified branchiæ, tetradaçtylous fore and pentadaçtylous hind-feet. This animal, in the Naturalist's Miscellany, is denominated *Gyrinus Mexicanus*, or Mexican tadpole. According to the description given in that work, it is a native of Mexico, and, if only the larva of some large American lizard, is scarcely a less singular

and curious animal than the firen. In its general appearance it bears some resemblance to the larva of the *Rana paradoxa*, but is furnished with gills, opening externally in the manner of a fish; the openings are very large, and the external flap is continued from the sides of the head across the throat beneath, so as completely to insulate the head from the breast; the gills themselves consist of four semi-circular bony or cartilaginous arches, which are denticulated or serrated on their internal or concave part, like those of fishes; on the opercula, or external flaps, are situated three very large and elegant branchial fins, or ramified parts, divided and subdivided into a vast number of slender or capillary processes. In these particulars it resembles the *S. lacertina*, except that in the latter animal the external opening to the gills is very small; the mouth is furnished in front with a row of extremely minute teeth; the tongue is large, smooth, and rounded at the tip; the rictus, or gape, when the mouth is closed, appears considerably wider than it really is, owing to a lateral fulcus proceeding from each corner to some distance; the feet are entirely destitute of webs, and they are furnished with rather weak claws; the front feet have four toes, and those behind five. Independently of the general colour of the animal, the whole skin, when minutely examined, appears to be scattered over with very minute white specks, resembling those on the surface of the *S. lacertina*. The sides of the body are marked by several strong rugæ or furrows, and an impressed lateral line or fulcus is continued from the gills to the tail.

SIREN is also a name given by Mousset, and other authors, to a species of bee; of which they distinguish two kinds, a larger and a smaller. These differ greatly from the common bee, in that they live solitary, and never unite into swarms, or build nests, or make combs.

SIRET, in *Geography*, a town of the province of Bukovina; 85 miles N.W. of Jassi.—Also, a river of Moldavia, which runs into the Danube; 4 miles S. of Galacz.

SIREX, or *Tailed Wasp*, in *Entomology*, a genus of insects of the order Hymenoptera, of which the generic character is, Mouth with a thick, horny, truncate, short, denticulate mandible; four feelers, the hind ones longer, and thicker upwards; antennæ filiform, of more than twenty equal articulations; the sting is exerted, ferrate and stiff; the abdomen is sessile, terminating in a point; wings lanceolate, incumbent, the lower ones shorter.

The larvæ of this genus are six-footed, soft, cylindrical; the head rounded; they perforate wood, and frequently eat their way into the bowels of other insects, and their larvæ, living upon them till they have utterly consumed their entrails; the pupa is folliculate: the perfect insect lives on the nectar of flowers. There are about twenty-six

Species.

* *GIGAS*. The abdomen of this species is yellow at the base and tip; the body is black-blue. This is the largest species in the whole genus: it surpasses a hornet in size, and is principally observed in the neighbourhood of pines and other cone-bearing trees: it is of a black colour, with the eyes, the base, and lower half of the abdomen, of a bright orange-yellow; the thorax is villose, and the wings of a transparent yellowish-brown; the sting, or terminal tube, is very conspicuous. The larva, which measures about an inch and a quarter in length, is of a yellowish-white colour, and inhabits decayed firs and pines; at first view it bears some resemblance to the larvæ of the beetle tribe, but is thinner in proportion, and furnished, at the tip of the abdomen, with a short black spine or process. It changes to a chrysalis in the month of July; first enveloping itself in a slight silken

web of a whitish colour. The chrysalis is of a lengthened shape, with the antennæ, legs, and terminal tube or process, very distinctly characterized. If the change to chrysalis takes place, as it sometimes does, in summer, the fly proceeds from it in the space of about three weeks; but if at the close of autumn, the animal continues a chrysalis the whole winter, emerging in the following spring. The male insect is considerably smaller than the female, and may be farther distinguished by the want of the caudal tube or process, so conspicuous in the female insect: the tip of the abdomen is also of a black colour. The eggs, which are deposited by the female in the decayed parts of the trees already mentioned, are very small, and of a lengthened oval shape, with pointed extremities.

PSYLLIUS. Abdomen yellow at the base and before the tip; the body is black. It inhabits different European countries, and is half the size of the last. The antennæ and legs are yellow, and the thighs black; the head is black, with a yellow spot on each side, behind the eyes; certain segments of the abdomen yellow.

COLUMBA. This is an American species, and is distinguished by its black body, marked by testaceous bands. The specific character is as follows: thorax villous, ferruginous; abdomen black, the sides are spotted with yellow; the antennæ are short and black, ferruginous at the base; the abdomen beneath is black, with a yellow streak; the projection is short, acute, ferrate, yellow tipped with black; the legs are yellow; hind-thighs black.

MAGUS. Black, thorax villous; tip of the antennæ, lateral spots on the abdomen, shanks, and base of the tarsi, are white. It is of the size of the *S. gigas*, and is found in many parts of Saxony. The abdomen beneath is white in the middle; the wings are dusky.

NIGRICORNIS. Thorax villous, blueish-black; abdomen ferruginous, blue at the base. It is found in North America. The head is shining blue-black; the antennæ are black; the legs are piceous; thighs yellow; sting pitchy.

FLAVICORNIS. Thorax villous, black, immaculate; four bands on the abdomen, antennæ, and legs, yellow. It is found at Labrador, in America. The head is black; the upper part of some of the segments is yellow; the appendage ferrate, yellow; the sting is black.

FUSCICORNIS. Thorax villous, black; abdomen with eight yellow bands; the antennæ are black; the legs are yellow. This, which is of the size of the *gigas*, inhabits Saxony. The wings are subtestaceous; the sting is black, with a yellow sheath; the horn of the abdomen is subulate, yellow tip with black; the thighs are black.

* **SPECTRUM.** The abdomen of this species is black; the thorax is villous, with a yellow stripe before the wings. It is found in this country, and in many other parts of Europe. The antennæ are black or yellow, and the legs are yellow.

* **JUVENCUS.** The abdomen is blueish-black; the thorax villous, immaculate. This also is a native of England and other European countries. The antennæ are black or yellow; the legs are yellow.

PHANTOMA. Abdomen above yellow, with black belts; the head and legs are yellow. It inhabits Germany. The mouth is black; the thorax yellowish before, beneath black; the abdomen beneath is black.

CYANUS. This is of a shining blue colour; the legs are yellow. It inhabits North America. The antennæ are black; the thorax subvillous; the wings are hyaline.

ALBICORNIS. Black; head with a white spot on each side; the antennæ are white in the middle. It is a native of North America. The antennæ are black at the tip; the

abdomen with a white dot on each side on the last segment but one; the legs are black; the shanks and ends of the tarsi are white.

NIGRITA. This is of a black-blue, immaculate; the hind-legs are compressed. It is a native of Saxony, and is of the same size as the *S. mariscus*, hereafter to be noticed.

* **CAMELUS.** The abdomen is black, the sides spotted with white; the thorax smooth. This is found in England and other European countries.

EMARGINATUS. Black; thorax emarginate before, and pale at the sides; the fore-legs are rufous. It inhabits Germany. The antennæ are black; the head is black, with a pale spot on each side; the sides of the thorax are slightly ferrate. The four front legs are rufous; the shanks are tipped with black; the hind ones are black; the thighs rufous.

DROMEDARIUS. Abdomen black, rufous in the middle, with a white dot on each side. The shanks are pale at the base. It is chiefly found at Kiel, and resembles the *S. camelus*. The head is black, with two white lines; the thorax is black, with a white dot before the wings; some of the segments of the abdomen are black, some rufous, one black, with a white spot on each side, and one is altogether black.

PACCA. Abdomen black, two of the segments are rufous, the rest dotted with white. This also is found at Kiel, and is the size of the *S. camelus*. The antennæ are black, a little thicker towards the tip; the thorax is villous and black, with two minute white spots on the fore margin; the horn of the abdomen yellowish, sting rufous; legs compressed, black.

SIMILIS. Black; first segment of the abdomen at the base and second rufous, the rest with five yellow spots. It inhabits the Cape of Good Hope. The head is black; the orbits yellow; antennæ ferruginous; the base and tip black; the thorax black, with a yellow dot on each side; the legs are rufous, the thighs black; the tail is pointed, without any projection.

VESPERTILIO. Black; abdomen ferruginous, the base is black. This is a small insect, and is found in divers parts of Germany. The antennæ are black, with a whitish ring; the tail is black beneath, without the appendage; the upper wings are white, with a broad brown patch before the tip, and white marginal dots; the legs are black, tip of the thighs and base of the shanks white.

MARISCUS. Of this species the abdomen is testaceous, the two last segments are black; the thorax villous. This is found in divers parts of Europe. Antennæ yellow; head with a yellow callous dot behind the eyes; the abdomen beneath is black, spotted with yellow; it has no sting.

TROGLODYTA. Smooth, black; abdomen with seven yellow dots, and two bands. It inhabits Saxony. The legs are yellow; the thighs black.

NOCTILIA. This is of a black-blue colour; the antennæ are black; the thorax is villous; the abdomen testaceous in the middle. It inhabits several parts of Germany, and is about the size of the *S. mariscus*. Thorax blue; abdomen blue at the base and tip; wings yellowish; legs yellow; hind ones compressed, black, the thighs yellow.

COMPRESSA. Black; abdomen compressed, ferruginous; the first and last segments are black. It inhabits Barbary, and is very small. Legs white; thighs black; hind ones black; the shanks are compressed, black, with two yellow dots, and three bands.

* **PYGMÆUS.** Abdomen compressed, black, with two yellow dots and three bands. It is a native of this country, and of other parts of Europe. This is one of the smallest of the European species, being, according to Linnæus, about the

the size of a gnat, with a black abdomen, marked by three yellow bands, the middle of which is interrupted. It is found in Sweden.

MACILENTUS. Black; abdomen compressed, yellow at the sides. It inhabits Barbary, and resembles the next. The head is black, with two yellow dots between the eyes; the thorax black, with a yellow dot, and a larger one beneath; the abdomen is yellow at the sides, and projecting into two bands on the back; the wings are hyaline; the rib black beyond the middle; the legs are black; the fore-thighs are yellowish.

* **TABIDUS.** Black; sides of the abdomen dotted with yellow; fore-shanks testaceous. It inhabits England, and a specimen is in Sir Joseph Banks's museum.

SIRGAI-SOUSAI-PO, in *Geography*, a town of Chinese Tartary. N. lat. $42^{\circ} 15'$. E. long. $117^{\circ} 50'$.

SIRGIAN, SERJAN, or Kerman, the ancient *Carmana*, a city of Persia, which at a former period rivalled the proudest cities of the empire; and its situation, in the direct road from the northern provinces of Persia and Bucharia to Gombroon, then the great emporium of the India trade, contributed to the increase of its opulence and prosperity. It has, however, suffered much from destructive wars, domestic and foreign, and from the plunder of an exasperated and licentious army. After having been courageously defended, in 1794, by Lutf Ali Khan, it was betrayed into the hands of his rival Aga Mohamed Khan, by Nujuf Kooly Khan, one of his treacherous adherents. The city was abandoned for nearly three months to the rapacity of the soldiers, the walls and public buildings were levelled with the ground, great numbers of the inhabitants were put to death, and 30,000 of them were exiled into the distant provinces of the empire: nor will it probably ever recover from the effects of this dreadful calamity. The present fortifications inclose but a small portion of the ancient city, which is quite deserted, and in a most ruinous condition. It is situated on the western side of an extensive plain, so close to the mountains as to be completely commanded by two of them. The walls are high, and built of mud, with 19 or 20 positions in each face, and a dry ditch, 20 yards wide and 10 deep. It has four gates, and the ark or citadel, where the governor resides, is on the S. side of the fort. Its present population is not more than 20,000 souls, of which some few are Guebres; there are also Armenians, Jews, and Hindoos in the place. Its trade is still very considerable; and it is celebrated for its manufacture of shawls, match-locks, and carpets, which are chiefly exported to Khorassan and the northern provinces, and returned in drugs, skins from Bockhares, furs, silk, steel, and copper. These articles, as well as pistachio nuts, carpets, rose-buds for preserves, and bullion, are sent to India, whence are imported, tin, lead, iron, chintz, wrought silk, spices, indigo, mastic, gold brocade, china and glass-ware, broad-cloth, hard-ware, &c. The bazar is well supplied with articles of every description, and in one part neatly arched with a fine blue stone, procured in the adjoining mountains. There are nine caravanseras within the walls, and many inferior ones both within and without. N. lat. $29^{\circ} 30'$. E. long. $56^{\circ} 50'$.

SIRGOULIN, a town of Chinese Tartary. N. lat. $41^{\circ} 53'$. E. long. $119^{\circ} 14'$.

SIRGUNE, a river of Prussia, which runs into the Frisch Haff, below Elbing.

SIRHIND, a circar of Hindoostan, between the soubah of Delhi and Lahore, bounded on the N. by Thibet, on the E. by the Jumnah, which separates it from Schaurunpour,

on the S. by the circar of Nardeck, and on the W. by Moultan and the province of Jallindar.—Also, a town of Hindoostan, and capital of the above-mentioned circar, N. of Delhi, supposed by some to be built on the spot where the battle was fought between Alexander and Porus. Justinian is said to have had silk from hence: it is an ancient city, but, like most of the Indian cities, has greatly declined: between it and Delhi are extensive plains, within which are situated the towns of Panniput and Carnawl, famous for great battles, both in ancient and modern times; 140 miles S.E. of Lahore. N. lat. $30^{\circ} 41' 30''$. E. long. $76^{\circ} 6'$.

SIRHUD, literally meaning a boundary, and metaphorically applied to a cold region, a district of Persia, comprehending most of the mountainous part of the province of Fars, extending from the latitude of Kazaroon to that of the town of Yezdekhast, situated on the bed of what appears to have been formerly a river, which separates this province from Irak. The plains which here intersect the mountains seldom exceed eight or ten miles in breadth, but vary in length from 15 to 100. They are in general fertile, and afford abundance of pasturage; neither are they so deficient in water as some have supposed. It is the want of population and of encouragement to industry that retards their improvement.

SIRI, among the Romans, were subterranean caves or vaults, in which wheat could be kept sound and fresh for fifty years.

SIRI, VITTORIO, in *Biography*, a writer in politics and history, was born at Parma about the year 1607: he was educated for the study of theology, and took the habit of the Benedictine order, in the monastery of St. John, and there began to publish a work entitled "*Mercurio Politico*," by which he acquired some temporary celebrity. Fifteen volumes of this work appeared successively, containing an account of the public events from 1635 to 1655. After this he added to it "*Memoriæ Reconditæ*," in eight vols. which going back to 1601 come to 1640. The author not only records facts, but endeavours to investigate causes in the secret negotiations of cabinets, and to give the documents confirming his narrative. Of these pieces, a great number is to be found in his publications, communicated by popes' nuncios and the ambassadors of different crowned heads, and especially by the ministers of Louis XIV. Through the influence of cardinal Mazarin, he was invited by that monarch to Paris, and presented to a secular abbey, on which occasion he quitted his religious habit for that of an ecclesiastic. He assumed to himself the title of counsellor, almoner, and historiographer to his most Christian majesty, and he spent all the latter years of his life at Paris, where he died in the year 1685, at the age of 78. He is characterized by biographers as a man without any fixed principles, who had a venal pen, which was always ready to justify and defend any cause, provided he was liberally paid for his services; yet the opportunities he possessed of gaining information from authentic sources, and the number of original documents published by him, have given a marked value to his works as materials for the history of his time. The circumstances of his being a foreigner, and writing in Italian voluminous publications little read in France, are said by Le Clerc to have induced him to speak more freely of Louis XIII., his brother and ministers, than the French writers have done. The first four volumes of his "*Memoriæ Reconditæ*" are extremely rare. A translation into the French language, of the most important parts of all his works, has been published in several volumes by M. Requier. Siri is said also to have written under a feigned name some pieces respecting the war of Montferrat.

SIRI, in *Geography*, a mountain of Thibet; 36 miles N.E. of Taringafong.

SIRI, or *Dsiri*, a town of Thibet; 45 miles E. of Taringafong.

SIRIA, or SIRJA, a town of Syria, in the pachalic of Aleppo; 70 miles S.E. of Aleppo.

SIRIAGULLY, a town of Mocaumpour; 20 miles S.S.W. of Mocaumpour.

SIRIAN, a sea-port town of Pegu, on the river Appoo; and whilst it remained in possession of the Portuguese, a place of great trade. Before their time it had a king of its own: it is now frequented by French, English, and Dutch; 72 miles S. of Pegu. N. lat. $16^{\circ} 54'$. E. long. $96^{\circ} 50'$.

SIRIASIS, in *Medicine*, from *σῖγος*, a cavity, a disease of children, so named by the older writers, in consequence of an accompanying depression of the fontanelle, but which in fact appears to have been an inflammation of the brain and its membranes; and accordingly Dr. Cullen ranks it as synonymous with *phrenitis*. It is very indistinctly described, and in some respects resembles hydrocephalus. Aëtius, indeed, expressly asserts that it is an inflammation of the brain and its membranes; but the only symptoms which he enumerates, are hollowness of the finciput and of the eyes, ardent fever, paleness, dry skin, and total loss of appetite. See Aëtius, *Tetrab. i. Serm. iv. cap. 13.* Forest. *Obf. Med. lib. xxviii. cap. 82.* Sennert. *Pract. lib. i. part. i. cap. 20.*

SIRIBOA, in *Botany*, Rumph. *Amboin. v. 5. 340. t. 117.* *Piper Siriboa*, Linn. *Sp. Pl. 51*, is a kind of long pepper, reckoned one of the kinds of Betle, and used for chewing with the *Areca*, or Betle nut, on account of its gratefully aromatic; and not too pungent, flavour. See PIPER.

SIRICA, in *Geography*, a town of Tripoli; 120 miles S. of Mesurada.

SIRICIUS, *Pope*, in *Biography*, was a native of Rome, and succeeded to the pontifical throne in 384. There are extant several letters of this pope, which are accounted his first decretals. In his first epistle, in answer to some questions proposed by Himerius, bishop of Tarragona, are many curious particulars of the ecclesiastical discipline observed at that period. He was a warm opposer of the Priscillianists and Jovinians, and in one of his letters relative to the latter, an example appears of the ancient manner in which the apostolic see passed its judgments: Siricius acquainted the church of Milan that he had condemned Jovinian and his followers, with the consent and advice of the priests, deacons, and all the clergy. In another of his letters, a cogent testimony is given of the reverence paid by the ancient popes to the decision of councils: it is addressed to some bishops respecting the heresy of one Bonofus, who was accused of asserting that the Virgin Mary had children after the birth of Christ. The pontiff replies, that the synod of Capua having ordained that the prelates in the vicinity of Bonofus should take cognizance of his cause, it did not belong to him to enter into the dispute. Siricius had the satisfaction of seeing ended the long continued schism of Antioch, the bishop of which, Flavianus, had occupied the see for a number of years, without being acknowledged by the Egyptian bishops. Through the mediation of John Chrysofom, a reconciliation was effected, and Flavianus was acknowledged by the pope, who died soon after in 398, leaving behind him a very respectable character.

SIRICON PLUMBI, a name given by some chemical writers to calcined lead, or the grey powder made of lead by a slight calcination in an open fire.

SIRINAGUR, SRINAGOR, or *Cashmere*, in *Geography*. See CASHMERE.

SIRINAGUR, or *Srinagur*, a town of Thibet, capital of a district in Alucknundra, or Alacananda, a branch of the Ganges, which has its source in the snowy mountains of Thibet, the position of which, according to Capt. John Guthrie, who visited it in 1789, is 85 miles from Coadwar Gaut, through the hills, and 60 colles from Hurdwar, up the Ganges to the E.N.E., ascertained by a compass and perambulator. Mr. Daniel, who visited it in the same year, gives the same idea of its geographical position. It is situated in an exceeding deep and very narrow valley, formed by mount Sewalick, the northern boundary of Hindoostan on one side, and the vast ridge of snowy mountains of Himmaleh, or Imaus, on the other. Mr. Daniel was much struck with the magnificence of the scenery of this valley, in which the thermometer rose, in the shade, to 100° , though in crossing the mountain of Sewalick, it stood at $58\frac{1}{2}^{\circ}$. We shall here subjoin some further particulars on this subject, with which we are furnished by a narrative of a survey for the purpose of discovering the sources of the Ganges, by Capt. Raper, communicated to the society at Calcutta. This survey was ordered by the supreme government of Bengal in 1807, and at the recommendation of Lieut. Col. Colebrooke, executed by Lieut. Webb, accompanied by Capt. Raper and Capt. Hearsay. The party commenced their tour at Hurdwar, an inconsiderable town of one street, in N. lat. $29^{\circ} 57' 9''$. E. long. $78^{\circ} 8' 30''$, April 1st, 1808. On the 13th of May they arrived at Srinagur, in N. lat. $30^{\circ} 10' 52''$. E. long. $78^{\circ} 43'$. The town is situated on the S. bank of the Alacananda, in the centre of a valley, which is about four miles in length, running nearly in the direction of E.N.E. to W.S.W., and about two miles in its greatest breadth. It extends along the banks of the river, and forms, in shape, a small segment of a circle, of which the stream constitutes the chord. The principal street runs through the city, about four furlongs in length, and contains the grand bazar. The houses are in general two stories high, constructed of large stones, with a shelving slated roof of shingles. The lower apartments are allotted for shops and merchandize, the upper for the accommodation of the families. The rigid uniformity of the buildings, both in structure and materials, shews what little advancement has been made in architecture, at the same time that it detracts from the beauty of the place. A narrow projecting verandah, or balcony, forms the only apparent difference in the houses of the higher class of inhabitants; and such a system of equality prevails, that one might suppose it the effect of design, or of a cautious fear to manifest an increase of wealth, by an ostentatious display in their outward appearance. Even those of the two chiefs by no means convey the idea of mansions appropriated to the residence of men to whom was committed the government of a province. When this capital was visited by Col. Hardwicke, in the year 1796, it was under the government of a raja, to whom it had hereditarily descended through many generations, and might then be supposed to be in its most flourishing state; yet its appearance did not indicate opulence or splendour; but since that period, many natural and fortuitous causes have combined to reduce it to a lower state of poverty and insignificance. The encroachments annually made by the Alacananda, on the houses contiguous to the river, the earthquake of 1803, which shook every building from its foundation, and the Gur'hali invasion at the close of the same year, devolved such an accumulation of evils on this devoted capital, that one might have inclined to conclude that it would not survive its native princes,

princes. Every house and every street, not excepting the palace of the raja, exhibited marks of dilapidation. Many of the inhabitants expressed their sorrow and regret on account of the events that had occurred, and spoke of their former sovereign with great tokens of feeling. Under its Gure'hali rulers the city is not likely to recover from this forlorn condition; for all classes of people complain much of the peculation of the chiefs, and of the injustice, with the want of method, that attends all their proceedings. The inhabitants are composed chiefly of the descendants of emigrants from the Dooab, Rohileund, and Audh. The Hindoos form the greatest proportion: the number of Mussulman families not exceeding sixty or seventy. Most of these are petty shopkeepers, who, to gain a scanty subsistence, are forced to enter into various speculations; and a piece of silk or a ser of onions may be procured at the same shop. The principal persons are the agents of great banking houses at Najibabad and in the Dooab, who are employed in the sale and exchange of merchandize and coins. They reside here only eight months in the year; quitting the hills, and returning to their houses, at the commencement of the rainy season. The traffic in silver and specie forms one of the most profitable branches of commerce, and is carried on to a considerable amount. Bullion and coins are imported, for the purpose of being converted into temashas, the currency of the hills; and as a constant coinage of them is kept up at the mint, the supplies are furnished by the Serrafs, who receive a premium, agreeable to the quality of the silver, amounting to one and a half, or two *per cent.* on the Farrakabad or Bareli rupee. The temasha is a small uneven silver coin, four of which pass for the nominal rupee of the hills; and five for the Farrakabad or Bareli. Spanish dollars also find their way hither, and are converted into the same currency. The inferior coin is a small piece, ten tacas of which are equal to one temasha.

The other articles of speculation consist in the produce of the hills, and imports from Bootan. The former are *bhang* (hemp); a coarse cloth, or sort of canvas, manufactured from it, called *bhangela*; lead, copper, drugs, gums, wool, and a species of flannel made from it called *pan'bi*; from Bootan are received chairs or cow-tails, musk in pods, saffron, borax, salt, drugs of different kinds, and a few shawls, which come by that route from Cashmere. Among the drugs is one called *nirbisi*, or zedoary. Hawks are also brought down from the hills. In exchange for the above, the following articles are supplied from the low countries. Coarse cotton and woollen cloths, silk, spices, Lahore salt, sugar and tobacco. On all these goods a greater or less duty is levied at Sirinagur, amounting, on an average, to one ana in the rupee, or about eight and a third *per cent.*; and additional duties are collected at different posts, in their transit through the country.

The territories which formerly belonged to the raja of Sirinagur, are now divided into 84 *perganahs*, included in three *pat'his*, or divisions, over each of which is appointed a military governor, who has the same jurisdiction in his own district.

In the year 1803 an army of 8000 or 10,000 men was sent from Nepal, to execute a project which had been long formed at the court of Nepal, *viz.* that of invading the territories of the raja of Sirinagur, and extending their possessions to Cashmere. The troops of the raja amounted to 15,000 or 20,000 men, principally mercenaries, who endeavoured to shun an engagement: the death of their chief secured the conquest of the whole country to the Gure'halis.

On taking a view of Sirinagur from a height, it has the appearance of a double valley; one situated on a level with

the river, the other on its banks, elevated about forty or fifty feet, and extending along the base of the mountain. The lower one, in which the city stands, has apparently been formed by the receding of the Alacananda from the fourth shore; and although the period be too remote to ascertain the fact, the appearance of the ridge or bank, marking the concavity, would incline one to suppose that such has been the case; and that, in its present progressive inclination, it is gradually returning to its former channel. From the bottom of the upper valley, to the city, is a space of three or four furlongs, laid out in small fields and inclosures, with a few mango trees, thinly scattered among them. Opposite to the city, the Alacananda divides into two or three streams, which reunite about one mile below. On one of the small islands are the ruins of buildings, which were formerly connected with the city. The aspect of the surrounding mountains is very barren; here and there a solitary tree may be seen; but the general features betray a rocky and unfriendly soil, and the little vegetation that is produced on them is soon parched up and dried. On the opposite side of the river, several hamlets are seen, situated along the foot of the hills, with which a communication is open, by a *jhula* to the W. and a ferry boat to the E. of the city. One of the largest of these villages is called *Rani Hat't*, containing a temple sacred to raja Iswara, at whose shrine some rites are performed, in imitation of the mysteries observed in the temple of the Cyprian goddess. It is inhabited chiefly by dancing women; and the ceremony of initiation to this society consists in anointing the head with oil, taken from the lamp placed before the altar; by which act they make a formal abjuration of their parents and kindred, devoting their future lives to prostitution. A short distance beyond it is a *Mat'h* or *sane* of Rallea Devi, the god of love; whose shafts, if we may believe the reports and complaints of his numerous votaries, are tainted with a fatal and pernicious poison: indeed, his wounds appear to be so generally diffused, that four-fifths of the inhabitants are supposed to labour under the effects of them, and the calamity is heightened by their ignorance of proper remedies to check their progress. Asiatic Researches, vol. xi.

SIRINAGUR, a town of Bengal; 20 miles N.N.E. of Calcutta. N. lat. 23° 7'. E. long. 88° 48'.

SIRIS, SIRO, or *Sinno*, in *Ancient Geography*, a river of Italy, near the *Acinis*, in Lucania. See *SINNO*.

SIRIS, a very ancient town of Italy, in Lucania, said by Strabo to have been founded by Trojans, and eminent for its college of priests skilled in cabalistic lore. It was situated at the mouth of a river of the same name, now called *Sinno* (which see), and became a dependance of Heraclea, to which the principal inhabitants of Siris were obliged to remove. When the Ionians took possession of this city, they changed its name into that of Policram. In process of time, the Tarentines drove the inhabitants from Siris, and having sent a colony into this country, they built Heraclea at a small distance from Siris. Strabo distinguishes these two towns; but Pliny (l. iii. c. 10.) says that they were the same under different names. The adjacent country was called *Siritis*, or *Sirentina*.—Also, a town of Pæonia, in Thrace.

SIRISHEK, in *Geography*, a town of Persia, in Khorassan; 30 miles S.S.W. of Herat.

SIRIUM, in *Botany*. See *SANTALUM*.

SIRIUS, σ_{1210} , in *Astronomy*, the *Dog-star*, a very bright star of the first magnitude, in the mouth of the constellation *Canis Major*, or the Great Dog.

This, indeed, is the brightest of all the stars in our firmament, and, therefore, probably, says Dr. Maskelyne, the late

astronomer royal, in a paper recommending the discovery of its parallax, *Phil. Trans.* vol. li. p. 889, the nearest to us of them all. Some, however, suppose Arcturus to be the nearest.

The Arabs call it *Afchere, Elschere, Scera*; the Greeks, *Sirius*; and the Latins, *Canicula*, or *Canis cadens*. See *CANICULA*.

SIRIUS, in *Geography*, an island in the South Pacific ocean, discovered and so called by lieutenant Ball, in 1790; it is about 18 miles in circumference. S. lat. 10° 52'. E. long. 162° 30'.

SIRMAN, *MAD.*, in *Biography*, a celebrated performer on the violin, who had her musical education in a conservatorio at Venice. Her maiden name was Maddalena Lombardini. She was a favourite élève of Tartini, and it was for her that he drew up his little tract on the use of the bow on the violin, in the form of a letter, "Arte dell' Arco."

After quitting the conservatorio, she married a German of the name of Sirman, and came to England in 1773; when her performance of Tartini's compositions on the violin was justly and universally admired. But in the operas of "Sofonisba" by Vento, and the "Cid" by Sacchini, she unadvisedly undertook the second woman's part on the stage, as a singer; but having been first woman so long upon the violin, she degraded herself by assuming a character, in which, though not deficient in voice or taste, she had no claim to superiority.

SIRMARKS, in *Ship-Building*, the different stations marked on the moulds where the respective bevellings are to be applied, as the lower firmark, floor-firmark, &c.

SIRMIONE, in *Geography*, a peninsula of Italy, about seven miles from the Lago di Garda, anciently celebrated under the name of Benanus, and always esteemed one of the grand ornaments of Italy. From *Peschiera* (which see), Sirmione appears as an island; so low and so narrow is the bank that unites it to the main land. Its entrance is defended, and indeed totally covered, by an old castle, with its battlements and high antique tower in the centre, in the form of a Gothic fortification. The promontory spreads behind the town, and rises into a hill, entirely covered with olives; which hill may be said to have two summits, as there is a gentle descent between them. On the nearest is a church and hermitage, now uninhabited and neglected. On the farthest, in the midst of an olive grove, stand the walls of an old building, said to be a Roman bath; and near it is a vault, called the grotto of Catullus. The extremity of this promontory is covered with arched ways, towers, and subterranean passages, supposed by the inhabitants to be Roman, but bearing, in fact, a strong resemblance to Gothic ruins. At all events, Catullus undoubtedly inhabited this spot, and preferred it, at a certain period, to every other region. He has expressed his attachment to it in some beautiful lines.

" Peninsularum Sirmio, insularumque
Ocelle, quascunque in liquentibus stagnis
Marique vasto fert uterque Neptunus:
Quam te libenter, quamque lætus inviso."

Catull. 32.

He could not, in fact, have chosen a more delightful retreat. In the centre of a magnificent lake, surrounded with scenery of the greatest variety and majesty, apparently secluded from the world, yet beholding from his garden the villas of his Veronese friends, he might have enjoyed alternately the pleasures of retirement and society; and daily, without the sacrifice of all his connexions, which Horace seemed inclined to make, in a moment of despondency, be-

held the grandeur and agitation of the ocean, without its terrors and immensity. Besides, the soil is fertile, and its surface varied; sometimes shelving in a gentle declivity, at other times breaking in craggy magnificence, and thus furnishing every requisite for delightful walks and luxurious baths; while the views vary at every step, presenting rich coasts or barren mountains, sometimes confined to the cultivated scenes of the neighbouring shore, and at other times bewildered and lost in the windings of the lake, and the recesses of the Alps. In short, more convenience and more beauty are seldom united; and such a peninsula is, as Catullus enthusiastically observes, scarcely to be matched in all the wide range of the world of waters.

SIRMIUM, or *SIRMICH*, a town of Slavonia, where the emperor Probus was born and killed. It is now in ruins, though the see of a bishop, founded, it is said, in the reign of Trajan. In the year 270, the emperor Claudius died here of the plague; 40 miles N.W. of Belgrade.

SIRMOND, *JAMES*, in *Biography*, a theologian of considerable note, born at Riom in 1559, was the son of a magistrate in that city. He was educated at a college of the Jesuits, which society he entered in 1576. Being sent to Paris, he taught in a college there, and at the same time pursued his studies with so much success, that he acquired a perfect knowledge of the learned languages, and formed a style in the latter, which, it is said, has rarely been excelled, either with respect to its strength or purity. He obtained so high a character for erudition, that he was summoned to Rome, in 1590, by Aquaviva, general of the order, to take upon him the office of his secretary. This office he held 16 years with high honour, and, in the mean time, he made use of all the advantages of the situation for the study of antiquities. He cultivated the acquaintance of all the great men of that period, among whom were Bellarmine, Barberini, and Baronio. To the latter he rendered important services in the composition of his Annals, especially by furnishing him with memorials relating to the Grecian history, translated into the Latin language. He returned to Paris in 1608, and resided four years in the house of the Jesuits, during which he edited several works of antiquity. He also entered into the controversy occasioned by Richer's famous treatise concerning the ecclesiastical and civil powers, in which he appeared as a partizan of the court of Rome. In 1612 he was employed in the labour of making a collection of the French councils; but this work did not cause him to intermit his publication of ancient writings; and a year seldom passed without sending one of them to the press, with learned commentaries. He was chosen rector of the Jesuits' college in Paris, in the year 1617, continuing to occupy himself as an editor and writer of original works. Pope Urban VIII. invited Sirmond to Rome, but Lewis XIII. would not consent to lose so eminent a scholar from his capital; and in 1637 he chose father Sirmond as his confessor. In this situation he conducted himself so as to merit the esteem of the king and his court. He rarely asked any favours for his relations; but he conferred an important benefit on his native place, by obtaining the revocation of an edict, which had transferred the board of finances of Auvergne from Riom to Clermont. When he quitted the court, he continued his literary occupations, which he pursued to a very advanced age. Huet, who, when a very young man, was introduced to Sirmond, then 90 years of age, found him inactive in body, but alert and vigorous with regard to his understanding and mental powers. He has described him as possessed of uncommon courtesy and elegance of manners, like one who had been long conversant with important public business.

ness. He died in 1651, at the age of 92. He was editor chiefly of the authors of the middle ages, the MSS. of which he discovered among the libraries at Rome, and other places. Those of his own composition were, in a great part, controversial. One, entitled "Censura de suburbicariis Regionibus," which related to the suburbicarian churches under the jurisdiction of the Roman pontiff, impugned the opinions of Godfrey and Saumaise. He had a dispute with Peter Aurelius respecting the second canon of the council of Orange, which was conducted on both sides with much acrimony. He was attacked with great bitterness, on account of a dissertation which he wrote, to prove that St. Denis the Arcopagite was a different person from St. Denis of France; but all fair judges of the subject admitted the validity of his arguments. He was less successful in a controversy respecting predestination, by which he became involved in hostility with the Jansenists. He never brought out, at first, all he knew on the subject, but made a reserve of some arguments for replication. His works were published collectively at Paris, in five volumes folio, 1696.

SIRNAME. See SURNAME.

SIROCC, or SIROCCO, a south-east wind of Sicily, particularly at Palermo, attended with an uncommon degree of heat, and singularly relaxing and oppressive in its effects. The blast of it is represented as resembling burning steam from the mouth of an oven: the whole atmosphere, during its continuance, seems to be in a flame. Its effect is described by Brydone like that of one of the subterranean sweating stoves at Naples; but it was much hotter. In a few minutes, those who are exposed to it find every fibre relaxed in a most inconceivable manner, and the pores opened to such a degree, that they expect immediately to be thrown into a most profuse sweat. At this time the thermometer, which stood in a room only at 73, rose immediately in the open air to 110, and soon after to 112. The air was thick and heavy, but the barometer was little affected, having fallen only about a line. The sun did not appear during the whole day; otherwise the heat, says Mr. Brydone, must have been insupportable; and on that side that was exposed to the wind, it could not be borne without difficulty for a few minutes. Upon exposing pomatum to it, the heat of the wind melted it as if it had been laid before the fire. This wind is more or less violent, and of longer or shorter duration at different times: however, it seldom lasts more than 36 or 40 hours, so that the walls of the houses are not warmed throughout, or else it is apprehended that it would be insupportable. Whilst it lasts, the people of the country confine themselves within; their windows and doors are shut close, to prevent the external air from entering; and where window-shutters are wanting, they hang up wet blankets on the inside of the window. The servants are constantly employed in sprinkling water through all the apartments, in order to preserve the air in as temperate a state as possible; and for this purpose, each house in the city of Palermo is provided with a fountain. By these means the people of fashion suffer very little from this wind, except the strict confinement to which it obliges them. Notwithstanding the scorching heat of the sirocco, it has never been known to produce any epidemical disorders, or to do any injury to the health of the people. They feel, indeed, very weak and relaxed after it; but a few hours of the Tramontane, or north wind, which generally succeeds it, soon braces them up again, and restores them to their former state. However, in Naples, and some other parts of Italy, where its violence is not to be compared with that of Palermo, it is often attended with putrid disorders, and

seldom fails to produce almost a general dejection of spirits. But there the sirocco lasts for many days, and even for weeks; so that, as its effects are different, it probably proceeds from a different cause. Some have supposed that this is the same wind with that which is so dreadful in the sandy deserts of Africa, where it sometimes proves mortal in the space of half an hour; but that in its passage over the sea, it is cooled and deprived of its tremendous influence, before it reaches Sicily. If this were true, we might expect to find it most violent on that side of the island that lies nearest to Africa, which is not the case; though it is possible, that its heat may be again increased by its passage across the island to Palermo, near the most northern part: and besides, this city is almost surrounded by very high mountains, the ravines and valleys betwixt which are entirely parched up and burning hot at this summer season of the year. These likewise contain springs of warm water, the steams of which may increase the heat, and at the same time soften the air, so as to disarm it of its noxious qualities. It is a practice too, at this season, to burn heath and brush-wood on the mountains, which must still add to the heat of the air.

SIROD, in *Geography*, a town of France, in the department of the Jura; 3 miles S.S.W. of Nozeroy.

SIRO-DEVA, a name of the Hindoo deity *Siva*; which see.

SIRONG, in *Geography*. See SERONGE.

SIROTE, a town of Bootan; 60 miles S.E. of Tafafudon. N. lat. 27° 18'. E. long. 90° 25'.

SIROWY, a circar of Hindoostan, in Agimere, lying on each side of the river Puddar, bounded N. by Jondpour, E. by Mewat, S. by Oudipour, and W. by sandy deserts. The chief towns are Sirowy and Jalour.

SIRPY, a town of Hindoostan, in the Myfore; 30 miles S.E. of Chittledroog.

SIRR. See SIR.

SIRSA, a town of Bengal; 30 miles S.E. of Ghidore.

SIRVENT, or VASIR, a town of Charafm; 60 miles S.E. of Urghenz.

SIRUN, a town of Persia, in the province of Segestan, or Seistan; 40 miles E. of Zareng.

SIRUPA, a town of New Mexico, in the province of Hiaqui; 80 miles N.E. of Riochico.

SIRZESZYN, a town of Lithuania, on the Dnieper; 50 miles N.E. of Mozyr.

SIS, a town of Asiatic Turkey, in the government of Sivas; 24 miles S. of Tocat.—Also, a town of Asiatic Turkey, in Caramania; 150 miles E.S.E. of Cogni.

SISAL. See SICAL.

SISALO, in *Ancient Geography*, a town of Spain, upon the route from Emerita to Saragolla, in passing by Lusitania, between Mirobriga and Corcuvium, according to the Itinerary of Antonine.

SISAN, a town of Asia, in the confines of Cilicia.

SISAPO, *Almaden*, a town of Spain, in Bætica, towards the east. Supposing it to be the same with Almaden, it yielded, in the time of the Romans, a mine of quicksilver, in high estimation, the produce and revenues of which were of great importance to the republic.

SISAPONE, the same with the former, a town of Spain, in the Tarragonensis, towards the confines of Bætica, which belonged to the Oresoni, according to Ptolemy.

SISAR, a river of Africa, in Mauritania Tingitana, between the towns of Chubar and that of Jerfeth, according to Ptolemy.

SISARA PALUS, the lake of Sifara, a lake of Africa, being the southern part of the lake Hipponibis, mentioned by Ptolemy.

SISARACA, a town of Spain, in the Tarragonensis, belonging to the Murbogi. Ptolemy.

SISARIS, *Mansourah*, a river in the eastern part of Mauritania Cæsariensis. Its mouth was five leagues N.E. of that of the river Nafava.

SISARMES, in *Ancient Armour*. See **GISARMES**.

SISARUM, in *Botany*, the Skirret, an eatable root, now out of use with us, though cultivated in the days of Gerard and Parkinson. Its flavour is said to be aromatic, with a sweetness not acceptable to every body, and of a flatulent, or indigestible, quality. See **SIUM**.

SISAURANUM, in *Ancient Geography*, a famous town of Persia, at the distance of two journeys from Dara and three miles from Rabdian, according to Procopius. This town was taken and razed by the emperor Justinian.

SISCAR, in *Geography*, a town of Spain, in Arragon; 19 miles E.N.E. of Balbaitro.

SISCO, a town of the island of Corfica; 6 miles N. of Bastia.

SISECKE, a river of Germany, in the county of Mark, which runs into the Lippe, a little below Lunen.

SISIBOU, or **SISSIBOU**, a town of Nova Scotia, on the W. coast; 25 miles S.S.E. of Annapolis.

SISINILLA, a town of the island of Cuba; 12 miles E.N.E. of Trinidad.

SISKIN, in *Ornithology*. See **SPINUS**.

SISNOVIA, in *Geography*, a town of Itria; 3 miles S.E. of Pedena.

SISOGUICHI, a town of Mexico, in the province of Biscay; 140 miles W. of Parral.

SISOLSK, **UST**, a town of Russia, at the confluence of the rivers Vim and Vithegda, in the province of Ulting; 120 miles N.E. of Ulting. N. lat. 61° 55'. E. long. 49° 40'.

SISON, in *Botany, a name adopted from Dioscorides, whose *σισων*, as he tells us, "is a little seed, produced in Syria, resembling parsley, oblong, black, and of a hot taste. Many of these seeds grow together at the tops of the stalks." There can be little doubt that this description applies to one of the umbelliferous order, but to what precise species or genus, can scarcely be guessed; nor did Dr. Sibthorp, when he examined the famous manuscript of Dioscorides at Vienna, find any thing to guide him respecting this point.—Linn. Gen. 139. Schreb. 188. Willd. Sp. Pl. v. 1. 1436. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 315. Prodr. Fl. Græc. Sibth. v. 1. 195. Ait. Hort. Kew. v. 2. 145. Pursh 194. Juss. 221.—Class and order, *Pentandria Digynia*. Nat. Ord. *Umbellatae*, Linn. *Umbelliferae*, Juss.*

Gen. Ch. *General Umbel* of fewer than six unequal rays; *partial* of fewer than ten unequal rays. *General involucrem* of about four unequal leaves; *partial* similar to it. *Perianth* scarcely discernible. *Cor.* *Universal* uniform; all the flowers fertile; *partial* equal, of five lanceolate, inflexed, flattish petals. *Stam.* Filaments five, capillary, the length of the corolla; anthers simple. *Pist.* Germen inferior, nearly ovate; styles two, reflexed; stigmas obtuse. *Peric.* Fruit ovate, striated, separating into two parts. *Seeds* two, ovate, convex and striated on one side, flat on the other.

Eff. Ch. Flowers uniform, all fertile. *General* and *partial involucrem* each of few leaves. Fruit ovate, striated. Petals lanceolate, inflexed.

1. *S. Amomum*. Hedge Honewort, or Ballard Stone-parsley. Linn. Sp. Pl. 362. Willd. n. 1. Fl. Brit. n. 1. Engl. Bot. t. 954. Jacq. Hort. Vind. v. 3. 13. t. 17. (*Petrofelinum macedonicum* Fuchsii; Ger. Em. 1016.)—Leaves pinnate. Umbels erect, of about four rays.—Native of England, Germany, the south of France, and the neighbour-

hood of the Bithynian Olympus. With us it chiefly occurs in moist shady places, where the soil is marly or chalky, flowering in August. The root is spindle-shaped, annual or biennial. *Stem* two or three feet high, branched, widely spreading, leafy, striated, smooth. *Leaves* dark green, smooth, finely pinnate, with a terminal lobed leaflet; the upper ones more compound or divided; all sharply serrated and cut. *Umbels* numerous, terminal, solitary, erect when in flower, white, but small and inconspicuous. *Fruit* roundish-ovate. *Seeds* aromatic and pungent when ripe. In a green state, their scent, like that of the whole herb, when bruised, is peculiarly nauseous, somewhat like *Coriander*, but even worse. These seeds have been known in the European Pharmacopæas by the name of *Amomum*, no one knowing what was the true *Amomum*; and have been celebrated as diuretic, useful in the stone and gravel, &c.; but they are now out of use, probably with no loss to the patient.

2. *S. fegetum*. Corn Honewort. Linn. Sp. Pl. 362. Willd. n. 2. Fl. Brit. n. 2. Engl. Bot. t. 228. Jacq. Hort. Vind. v. 2. 63. t. 134. (*Selinum filifolium*; Ger. Em. 1018. *Sium terrestre*, seu *fegetale*; Morif. sect. 9. t. 5. f. 6.)—Leaves pinnate; leaflets roundish, numerous. Umbels drooping, shapeless.—Native of England and Switzerland, but rare, chiefly in moist low fields, on a calcareous soil, flowering in August. Scarcely any body but a curious botanist would observe this little plant, which appears like a starved specimen of many a more common kind. The numerous crowded leaflets, imbricated, in a manner, before they expand, and the straggling, drooping, little umbels, are peculiar. The flowers, and their anthers, are tinged with purple.

3. *S. canadense*. Three-leaved Canadian Honewort. Linn. Sp. Pl. 363. Willd. n. 3. Ait. n. 3. (*Chærophyllum canadense*; Pursh 195. *Myrrhis canadensis*; Riv. Pentap. Irr. t. 54. *M. canadensis trilobata*; Morif. sect. 9. t. 11. f. 4.)—Leaves ternate. *General involucrem* wanting. *Seeds* elliptic-oblong.—Common in the woods of North America, from Canada to Virginia, flowering in July. *Pursh*. *Root* perennial, of many tapering fibres. *Stem* two feet high, branched, round, smooth, leafy. *Leaflets* smooth, broad, acute, doubly and sharply serrated; the lateral ones, of the lower leaves, often deeply divided, and their intermediate one sometimes three-lobed. *Umbels* slender, unequal, destitute of a general involucrem, and with very small partial ones, but otherwise having the genuine habit of this genus, and no character of *Chærophyllum*. *Fruit* elliptic-oblong, strongly ribbed, smooth, crowned with the small, conical, converging styles.

4. *S. Ammi*. Fennel-leaved Honewort. Linn. Sp. Pl. 363. Willd. n. 4. Jacq. Hort. Vind. v. 2. 95. t. 200. (*Ammi*; Camer. Epit. 522. Matth. Valgr. v. 2. 120. Riv. Pentap. Irr. 91. *A. perpusillum*; Lob. Ic. 725. Ger. Em. 1037.)—Leaves triply pinnate; the radical ones with linear segments; the upper setaceous.—Native of Portugal, Italy, and Egypt. A slender, annual, smooth plant, about a foot high, with an aromatic parsley-like smell. Segments of the leaves alternate, or ternate, acute. *General umbels* of five or more rays, with an unequal, somewhat leafy, *involucrem*; *partial* of numerous short rays; their *involucral leaves* linear, minutely fringed. Jacquin says his plant had neither general nor *partial involucrem*. *Flowers* white. *Germen* in the original Linnæan specimen, from Clifford's garden, ovate, minutely granulated, of which mark we find no account. The ripe seeds are described by Jacquin and Rivinus as ovate.

5. *S. pusillum*. Dwarf Honewort. Michaux Boreal-Amer. v. 1. 168. Pursh n. 1. (*Daucus divaricatus*; Walt.

Walt. Carol. 114, according to Pursh.)—"Leaves twice-ternate, many-cleft. Partial umbels of three to five flowers. Seeds roughish." In dry sandy fields in Carolina, flowering in April and May. *Root* annual. *Pursh.*

6. *S. trifoliatum*. Three-leaved Carolina Honewort. Michaux, *ibid.* Pursh n. 2.—"Leaves all ternate; leaflets toothed; the lower ones oval, with two or three lobes; upper oval-lanceolate. Umbel terminal, stalked, solitary. Seeds roundish."—Found by Michaux in North Carolina.

7. *S. marginatum*. White-edged Honewort. Michaux, *ibid.* Pursh n. 3.—"Leaves pinnate; the upper ones quinque; leaflets all fertile, lanceolate, entire, bordered with white. General and partial involucre wanting."—In wet meadows, from Virginia to Carolina, flowering in July and August. Perennial. *Pursh.*

8. *S. falsum*. Salt Honewort. Linn. Sp. 181. Willd. n. 7. ("Peucedanum redivivum; Pallas Act. Petrop. 1779. v. 2. 252. t. 8. f. 1—3.")—Leaves radical, doubly pinnate; leaflets digitate, somewhat whorled. Stem leafless, panicled, with numerous umbels.—In dry, muddy, salt plains about the Wolga; gathered by Pallas, whose specimen is before us. The *root* is perennial. *Leaves* all radical, appearing in the spring, stalked, spreading, three inches long, doubly compound, the *leaflets* crowded as if whorled, in many smooth, oblong, brittle-pointed segments, all together resembling some feathery sort of *Conserva*. *Stem* appearing after the leaves are gone, twelve or eighteen inches high, slender, round, smooth, bearing in August a panicle, alternately compounded, of slender spreading *umbels*, each of from three to five rays. At the base of each branch is a sharp membranous-bordered leaf, or *bractea*. *Partial umbels* of five or six capillary rays. *General involucre* of two or three small membranous leaves; *partial* like it, but smaller. *Flowers* white. *Germen* ovate. *Fruit* more oblong, smooth, obscurely ribbed. Some of the *flowers* in each partial umbel do indeed appear to be abortive, whence perhaps Pallas referred this curious species to *Peucedanum*; but we find no traces of a wing to the seeds, to confirm that measure.

9. *S. crinitum*. Capillary-leaved Honewort. Willd. n. 8. "Pallas Act. Petrop. 1779. v. 2. 250. t. 7."—"Radical leaves triply pinnate: those of the stem bipinnate; leaflets brittle-shaped. General involucre of many doubly pinnate leaves."—Native of Siberia. *Pallas*. We have not seen the plate cited, but the *involucre* is described as doubly compound and setaceous.

Two British Linnæan species, the *inundatum* and *verticillatum*, are removed, in the Flora Britannica, from the present genus; the former to HYDROCOTYLE, and the latter to SIUM; see those articles. We are as confident of the propriety of this alteration, as it is possible to be on any question regarding the genera of umbelliferous plants. *Sison* itself is considered, by some botanists, as a doubtful genus, and is reduced to *Sium* by Lamarek in his Dictionary, v. 1. 404.

Sison Syriacum, a name given by some authors to the ammi, or bishop's weed, a plant whose seeds were once much used in medicine.

SISSA, in *Geography*, a town of the duchy of Parma; 11 miles N.N.W. of Parma.

SISSACH, a town of Switzerland, in the canton of Bâle; 13 miles S.E. of Bâle.

SISSAN, a town of Itria; 3 miles E.N.E. of Pola.

SISSYPTIEPTERIS, in *Botany*, a name used by Pliny, and some others of the old authors, for the pimpinella, or burnet.

SISSONNE, in *Geography*, a town of France, in the department of the Aisne, and chief place of a canton, in the

district of Laon; 10 miles E. of Laon. The place contains 1105, and the canton 10,327 inhabitants, on a territory of 337½ kilometres, in 20 communes.

SISSOPOLI. See SIZEBOLI.

SISSUER, a town of Hindoostan, in Oude; 24 miles E.S.E. of Manickpour.

SISTAN, or SEGESTAN. See SEISTAN.

SISTER, a female born of the same parents.

SISTER-Blocks, in *Block-Making*, are blocks made of ash, similar to two single blocks, and turned out of a solid piece, about two inches long, one above the other: between the blocks is a score for a middle-feizing; a round head is turned at each end, and hollowed underneath, to contain the end-feizings: along the sides, through which the pins are driven, is a groove, large enough to receive part of the top-mast shroud, in which it is seized. In these blocks receive the lifts, and reef-tackle pendants of the top-sail-yards.

SISTERON, in *Geography*, a town of France, and principal place of a district, in the department of the Lower Alps, situated on the Durance, with a small castle on a rock; and before the revolution the see of a bishop, suffragan of Aix; 15 miles N.W. of Digne. The place contains 3891, and the canton 7070 inhabitants, on a territory of 230 kilometres, in 9 communes. N. lat. 44° 11'. E. long. 6° 1'.

SISTERS, two small islands in the Red sea. N. lat. 10° 30'. E. long. 39° 15'.—Also, two very small islands near the coast of Sumatra, covered with wood, lying in S. lat. 5° 0½'. E. long. 106° 12'; nearly N. and S. from each other, and surrounded by a reef of coral rocks; the whole circumference of which is about four or five miles.

SISTERSDORF. See ZISTERSDORF.

SISTOTREMA, in *Botany*, a genus of *Fungi*, of which several species are described, and some figured, in Albertini and Schweiniz's very learned work, entitled *Conspicuum Fungorum in Lusatia superioris agro Niskiensi crescentium*, p. 260—264. We, however, find there no generic character. The plants seem most akin to HYDNUM; see that article. The name appears to be compounded of *συσω* and *τετραμα*, alluding to the regular rows of pores; but if so, it ought to be *Systotrema*.

SISTOVA, or SZISTO, in *Geography*, a town of European Turkey, in Bulgaria, on the right bank of the Danube; 25 miles E. of Nicopoli. N. lat. 43° 45'. E. long. 24° 44'.

SISTROID Angle. See ANGLE.

SISTRUM, a sacred musical instrument with the ancient Egyptians; and one that is still used by the Abyssinians in religious ceremonies.

Spon describes it of an oval form, made in manner of a racket, with three sticks traversing it breadthwise, which, playing freely by the agitation or beating of the instrument, yielded a kind of sound, which, to the ancients, seemed melodious. The upper part was adorned with three figures; that of a cat with a human face in the middle, the head of Isis on the right side, and the head of Nephthys on the left. The representation which we have given in the *Plate of Music* was drawn from an ancient sistrum preserved in the library of St. Genevieve at Paris. It has been disputed by the abbé Winekelman, whether the sistrum was of very high antiquity in Egypt, because it did not appear in the hands of such Egyptian statues as he had seen at Rome; but as there is one in the hand of a very ancient statue of Isis, which doctor Pococke brought into England from Egypt, it puts that point of musical history out of all dispute. The sistrum appears in the *Isiac Table*; and Apuleius makes an old Greek invoke an Egyptian priest "by the stars in the firmament; by the infernal divinities; by the elements which

which compose the universe; by the silence of the night; by the sanctuary in the temple of Coptos; by the increase of the Nile; by the mysteries of Memphis; and by the sitrum of Pharos." By Pharos, an Egyptian island, was here figuratively meant, all Egypt.

Mr. Malcolm takes the sitrum to have been no better than a kind of rattle. Jer. Bosius has an express treatise on the sitrum, intitled, "Isiacus de Sitro."

Osefius observes, that the sitrum is found represented on several medals; and also on talismans. Osiris, on some medals, is painted with the head of a dog, and with a sitrum in his hand.

SISUPALA, in *Hindoo Mythology*, is the name of a malignant personage, into whose body an insolent celestial was doomed to be re-born on earth, as an expiation of his offence. He was slain by Krishna.

SISY-*sur-Ourcq*, in *Geography*. See LIZY-*sur-Ourcq*.

SISYMBRIUM, in *Botany*, Σισυμβριον of the Greeks, at least the Σ. ἕλερον of Dioscorides is probably included under our present genus. His first species, celebrated for its fragrance, has been supposed Wild Thyme, and by some our *Mentha hirsuta*, which last has also occasionally a very sweet smell. De Theis seems not to have been aware of this; nor might the plant in question find a place in garlands dedicated to Venus, so much on account of its odour, as of its warm and cordial properties.—Linn. Gen. 338 Schreb. 441. Willd. Sp. Pl. v. 3. 489. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 700. Prodr. Fl. Græc. Sibth. v. 2. 18. Ait. Hort. Kew. v. 4. 111. Pursh 440. Jull. 239. Lamarck Dict. v. 7. 201. Illustr. t. 565.—Class and order, *Tetradynamia Siliquosa*. Nat. Ord. *Siliquosa*, Linn. *Crucifera*, Juss.

Gen. Ch. *Cal.* Perianth inferior, of four lanceolate-linear, spreading, coloured, deciduous leaves. *Cor.* cruciform, of four oblong spreading petals, often less than the calyx with very small claws. *Stam.* Filaments six, longer than the calyx, of which the two opposite ones are rather the shortest; anthers simple. *Pist.* Germen oblong-thread-shaped; style scarcely any; stigma obtuse. *Peric.* Pod long, incurved, gibbous, round, with two cells and two straight valves, which are rather shorter than the partition. *Seeds* numerous, small.

Ell. Ch. Pod bursting, with nearly straight valves. Calyx and corolla spreading.

A copious genus, tolerably natural as to habit, but not very distinctly defined; of which the 14th edition of Linn. Syst. Veg. contains twenty-nine species, and Willdenow's Sp. Pl. fifty-three. Nine of them are found wild in Britain. We shall describe all the latter, and give a general view of the five sections, into which the whole genus is divided by Linnaeus. Mr. Brown, in his very ingenious attempt at reforming the genera of the class *Tetradynamia*, in Ait. Hort. Kew. has separated some species, principally of the first section, into a genus called *Nasturtium*, and he has referred two of the British ones to *SINAPIS*, (see that article,) and one to *BRASSICA*. Respecting these very species, there has heretofore been a difference of opinion among botanists, as will appear when we come to speak of them in order. The whole genus is herbaceous, either annual or perennial, with alternate leaves, various, and sometimes inconstant, in shape and division mostly smooth. The flowers are almost invariably yellow; though always white in the first species.

SECT. 1. *Pods declining, short.* Eleven species in Willdenow.

S. Nasturtium. Common Water-cress. Linn. Sp. Pl. 916. Willd. n. 1. Fl. Brit. n. 1. Engl. Bot. t. 855.

Curt. Lond. fasc. 6. t. 44. Woodv. Med. Bot. t. 48. Fl. Dan. t. 690. (*Nasturtium officinale*; Br. in Ait. Hort. Kew. v. 4. 110. *N. aquaticum*, five *Crataegium*; Ger. Em. 257.)—Pods declining. Leaves pinnate; leaflets roundish-heart-shaped.—In clear rivulets and springs throughout Europe, from Sweden to Greece, as well as in North America; and, according to Mr. Pursh, on the high mountains of the island of Dominica. It is perennial, flowering in June and July. No British plant is in such popular request as a salad; the young leaves having a pleasantly warm pungent flavour, and being supposed, like scurvy-grass, to purify the blood. The stems are branched, angular and leafy, floating by the help of their foliage, sending down long, white, fibrous roots, and terminating in ascending corymbose tufts, of numerous, white, purplish-tinted flowers, succeeded by long clusters of short, gibbous, recurved, stalked pods. The leaves are smooth, of a dark shining green, consisting of five or seven leaflets, the terminal one largest. There can be little doubt of this being Σισυμβριον ἕλερον of Dioscorides. The modern Greeks call it νεροάδδαμον; a word synonymous with Water-cress.

S. sylvestre. Creeping Water Rocket. Linn. Sp. Pl. 916. Willd. n. 2. Fl. Brit. n. 2. Engl. Bot. t. 2324. Curt. Lond. fasc. 3. t. 41. (*Nasturtium sylvestre*; Br. in Ait. Hort. Kew. v. 4. 110. *Eruca aquatica*; Ger. Em. 248. *Brachiolobos sylvestris*; Allion. Pedem. v. 1. 278. t. 56. f. 2.)—Pods declining. Leaves pinnate; leaflets lanceolate, deeply ferrated or cut.—Native of gravelly waste ground, in marshy places, or near rivers, flowering from June to September, in several parts of England, as well as in Germany, Switzerland, and France. Dr. Sibthorp observed it on mount Hæmus. The root creeps so extensively, that the pods are mostly abortive. Stems erect, leafy, angular, zig-zag, roughish, somewhat panicled. Leaves smooth; the leaflets of the lower ones decurrent, variously toothed; of the upper narrower, more slightly cut or ferrated. Flowers of a golden yellow; their clusters after flowering elongated and zig-zag.

Willdenow supposes *S. lippizense*, Jacq. Ic. Rar. t. 505, to be a variety of this, with more entire leaflets; but it is drawn with a fibrous, not creeping, root.

S. terrestre. Annual Water Rocket. Curt. Lond. fasc. 5. t. 49. Fl. Brit. n. 3. Engl. Bot. t. 1747. (*S. palustre*; Willd. n. 3. Pollich v. 2. 230. Pursh n. 2. *S. amphibium* α; Hudf. 296. *Nasturtium terrestre*; Br. in Ait. Hort. Kew. v. 4. 110. *Raphanus aquaticus*, foliis in profundas lacinias divisis; Bauh. Prodr. 38.)—Pods declining, turgid. Leaves pinnatifid, unequally toothed. Root simply fibrous. Petals scarcely so long as the calyx.—Found in watery places, about the sides of ditches, in the north of Europe, as well as America. Very plentiful about London, flowering from June to September.—The root is annual, sometimes branching at the top, but not creeping. Stem a foot high, nearly upright, branched, leafy, furrowed, smooth. Leaves lyrate, unequally toothed. Flowers numerous, yellow, small and inconspicuous, succeeded by short, turgid, erect pods, whose partial stalks are widely extended.

S. amphibium. Great Water Rocket, or Radish. Linn. Sp. Pl. 917. Willd. n. 4. Fl. Brit. n. 4. Engl. Bot. t. 1840. Pursh n. 3. Fl. Dan. t. 984. (*S. amphibium* β; Hudf. 296, and γ, 297. *Nasturtium amphibium*; Br. in Ait. Hort. Kew. v. 4. 110. *Raphanus aquaticus* alter; Bauh. Prodr. 38. *R. aquaticus*; Ger. Em. 240.)—Pods declining, on longish partial stalks. Leaves oblong, pinnatifid or ferrated. Petals longer than the calyx.—Not rare in the rivers and ditches of America, and the north of Europe;

SISYMBRIUM.

Europe; frequent in England, flowering copiously in July and August. In running streams it grows to a great size, with long floating stems, throwing out abundance of white fibrous radicles, and bearing, under water, deeply pectinated leaves. On the neighbouring banks it is found smaller, with broader, and merely serrated, foliage. The primary roots are perennial, long, perpendicular, not creeping. The leaves which grow out of the water are more or less oblong, jagged, clasping the stem with their dilated base; the radical ones stalked. Flowers yellow, not very bright. Pods short and small, often abortive. This seems to be the plant which Chateaubriand observed in Suffolk, and of which he has given so extravagant an account in his travels; as if the works of the Creator were not, of themselves, sufficiently admirable, without bombast or exaggeration.

S. tanacetifolium. Tanly-leaved Wild-rocket. Linn. Sp. Pl. 916. Willd. n. 6. Ait. n. 12. (Eruca, n. 460; Hall. Hist. v. 1. 200. E. tanacetifolio; Morif. sect. 3. t. 6. f. 19. E. fruticoso, con foglie di tanaceto, indiana; Zanon. It. 86. t. 33.)—Leaves pinnate; leaflets lanceolate, cut or deeply serrated; hoary beneath; the ultimate ones confluent. Pods erect, somewhat club-shaped.—Native of thickets and groves, on the loftiest alps of Savoy and Switzerland, but esteemed one of the rarest plants of those countries. We gathered it in seed on mount Cenis, August 13, 1787. Miller is said to have cultivated this *Sisymbrium* in 1731, and we believe it is still to be met with in curious collections. The root is perennial. Stem two or three feet high, clothed with very handsome spreading leaves, finely downy and hoary beneath, and often besprinkled with minute starry hairs on their upper surface. Flowers of a golden yellow, numerous, in terminal corymbs, growing out into long, lax clusters of smooth, erect, obtuse pods, half an inch or more in length, tapering at their base; their partial stalks about the same length, ascending obliquely.

S. tenuifolium. Wall Wild-rocket. Linn. Sp. Pl. 917. Willd. n. 9. Fl. Brit. n. 5. Engl. Bot. t. 525. (*Brassica muralis*; Hudf. 290. Curt. Lond. fasc. 3. t. 38. *Sinapis tenuifolia*; Br. in Ait. H. Kew. v. 4. 128. *Sinapi erucæ folio*; Bauh. Pin. 99. Tourn. Inst. 227. *S. tertium*; Matth. Valgr. v. 1. 516. *Eruca sylvestris*; Ger. Em. 246.)—Pods erect, somewhat beaked. Leaves smooth, pinnatifid or bipinnatifid, nearly entire; the uppermost undivided.—Native of old walls and rubbish, in England, Germany, Switzerland, and France, as well as about Constantinople, flowering from July to October. The root is perennial. Plant bushy, smooth, somewhat glaucous. Leaves acute, variously sinuated and pinnatifid; their segments lanceolate. Flowers large, lemon-coloured, strongly scented. Pods distant, tipped with the slightly elongated style.

S. sagittatum. Arrow-leaved Wild-rocket. Willd. n. 10. (*S. molle*; Jacq. Coll. v. 1. 68. Ic. Rar. t. 122. *Nasturtium sagittatum*; Br. in Ait. H. Kew. v. 4. 111.)—Downy. Leaves oblong, with shallow teeth; the radical ones hastate; the rest clasping the stem with their arrow-shaped base.—Native of Siberia. Sent to Kew, by Pallas, in 1780. The root is spindle-shaped, perennial. Whole plant clothed with soft, depressed, somewhat stellated down. Leaves bluntish, bearing some resemblance to those of Shepherd's Purse. Flowers yellow, succeeded by long clusters of drooping downy pods.

SECT. 2. Pods often axillary, nearly sessile. Five species.

S. polyceratum. Dandelion-leaved Wild-rocket. Linn. Sp. Pl. 918. Willd. n. 13. Ait. n. 11. Prodr. Fl. Græc. n. 1535. Jacq. Hort. Vind. v. 1. 34. t. 79. (*Iris alter*; Matth. Valgr. v. 1. 524. *Erysimum alterum italicum*; Ger. Emac. 254.)—Pods axillary, aggregate, awl-

shaped, nearly sessile. Leaves wavy or toothed.—Native of Switzerland, France, Italy, and Greece. Dr. Sibthorp found it, very common, throughout the last-mentioned country and the islands of the Archipelago, in waste ground, court-yards, and about villages, as Dioscorides reports of his *εγυσιμπος*, which therefore the Oxford professor judged this plant to be; perhaps rightly; but the description of the Greek author, particularly the yellow flowers, and the terminal pods, answer better to our *Erysimum officinale* (*Sisymbrium officinale*, Br. in Ait. H. Kew. n. 1.), which is also a Greek plant. The present *Sisymbrium*, a mean and ill-looking weed, is perfectly naturalized about Bury, in Suffolk, and might be taken for a native British plant, had we not the authority of sir T. G. Cullum, for its having escaped, many years since, from the botanic garden of the Rev. Mr. Laurence of that town. The root is annual. Stems branched, decumbent, leafy, smooth, gradually elongated after flowering. Leaves about an inch long, on short stalks, simple, somewhat hastate, slightly toothed or wavy, smooth. Flowers small, white, axillary, on short stalks, two or three together. Pods rather curved, an inch long, uneven, smooth, with a zig-zag furrow along each side.

S. torulosum. Rough-podded Wild-rocket. Desfont. Atlant. v. 2. 84. t. 159. Willd. n. 16. Sm. Fl. Græc. Sibth. t. 632, unpublished.—Pods racemose, sessile, awl-shaped, hairy. Stem diffuse. Leaves lanceolate, toothed.—Native of uncultivated fields, in Tunis, and the isle of Cyprus. An annual, branched, nearly prostrate herb, very like the last in general appearance, but the leaves are longer, truly lanceolate, and regularly toothed. Flowers terminal, densely corymbose, white, their stalk lengthening out into a long cluster, or rather spike, of crowded, sessile, spreading, rugged, hairy pods, each about an inch in length.

SECT. 3. Stem for the most part naked. Eight species.

S. murale. Sand Wild-rocket. Linn. Sp. Pl. 918. Willd. n. 17. Dickf. Dr. Pl. 12. Engl. Bot. t. 1090. Fl. Brit. 1401. (*Eruca viminea*, *iberidis folio*, luteo flore; Barrel. Ic. t. 131. *Sinapis muralis*; Br. in Ait. H. Kew. v. 4. 128.)—Pods erect. Stem spreading, short, roughish. Leaves lanceolate, deeply serrated.—Native of France, Italy, and the isle of Thanet, in waste sandy ground, flowering in autumn. Root truly annual. Stems branching, diffuse, often very short, leafy, round, more or less rough with deflexed hairs. Leaves of a grass green, tapering at the base into long footstalks; their margin deeply and irregularly serrated. Flowers smaller than those of *S. tenuifolium*, their corymbs becoming long loose clusters of erect, cylindrical, smooth pods, on spreading, hairy stalks. *S. Erucastrum*, Gouan Illustr. t. 20, is precisely this plant, not a variety.

S. monense. Dwarf Sea Wild-rocket. Linn. Sp. Pl. ed. 1. 658. Fl. Brit. n. 6. Engl. Bot. t. 962. Willd. n. 18. Lightf. Scot. 353. t. 15. f. 1. (*Brassica monensis*; Hudf. 291. Br. in Ait. H. Kew. v. 4. 124. *Eruca monensis laciniata*, flore luteo majore; Dill. Elth. 135. t. 111. f. 135.)—Pods nearly erect, quadrangular, with a long beak. Leaves pinnatifid, slightly hairy. Stems simple, almost naked, smooth.—Native of the sandy shores of Bute, Arran, and the west of Scotland, as well as of Cumberland, and the isles of Walney, Anglesea, and Man. Root thick, woody, and perennial. Stems several, a span high, leafy at the bottom only. Leaves almost all radical, numerous, stalked, rather fleshy and glaucous; their segments deep, tolerably uniform, either entire, or with broad incisions. Flowers large, numerous, lemon-coloured, corymbose, succeeded by a long cluster of smooth, obscurely quadrangular, upright, stalked, long-beaked pods. Calyx
lefs

less spreading than in most of the species, its leaves hairy at the tips. *Petals* veined.—We have been led to doubt whether Gerard's plant from Provence, described in the second edition of Sp. Pl. and preserved in the Linnæan herbarium, be the same with our's; because its *flowers* are smaller, and the veins of their *petals* scarcely discernible, though in our's very strong. It may nevertheless be a mere variety. We find in its young *Pods* plain indications of the remarkable lanceolate beak, half the length of the *pod* itself, so striking in our *S. monense*, and figured, as well as described, in English Botany. Willdenow was misled by Villars to consider Gerard's as the same with the following.

S. repandum. Wavy-leaved Wild-rocket. Willd. n. 19. (*S. monense*; Villars Dauph. v. 3. 350. t. 39, the synonyms mostly, if not entirely, wrong.)—*Pods* nearly erect, compressed, uneven, with a short quadrangular beak. Leaves with wavy teeth, smooth. Stems simple, smooth, quite naked.—Native of the mountains of Dauphiny; our specimen is from Villars himself, and proves, notwithstanding his assertion, very distinct from the plant of Gerard, mentioned under our preceding species, as well as from British specimens of that species. We have no means of knowing exactly how far the author is correct in Tournefort's synonym; but the phrase *radice crassâ* answers admirably to Gerard's specimen, and not to that of Villars. The *root* of the latter is long and tapering, divided, but not very thick, at the crown, where it bears several simple tufts of stalked, oblong, or obovate, bluntish leaves, about an inch only in length, always quite smooth; their margins either wavy, or more or less deeply toothed. *Stems* solitary, four or five inches high, quite leafless, simple, round and smooth, each bearing from four to nine large corymbose flowers, of a fine yellow. *Calyx* smooth, slightly spreading, a little coloured. *Pods* slightly spreading, rather longer than the last as to their valvular part, measuring from one and a half to two inches; but the beak is hardly two lines, instead of three-quarters of an inch, long, by which the plants are clearly distinguished. Willdenow rightly describes the *valves* of the present, which are unequally bunched out by the seeds, as marked with an elevated line, that makes them seem quadrangular; but they are much less really so than in *S. monense*, whose *Pods* few botanists appear to have seen.

S. vimineum. Rushy-stalked Wild-rocket. Linn. Sp. Pl. 919. Willd. n. 21. (*Eruca pumila*, burfæ pastoris folio; Bocc. Sic. 19. t. 10. f. 2. *E. minimo flore*, monfeliensis; Bauh. Hist. v. 2. 862; the leaves, as the author observes, too sharp.)—*Pods* erect, compressed, with a short quadrangular beak. Stems widely spreading, leafy at the base. Leaves smooth, obovate; toothed or pinnatifid. *Petals* erect, scarcely exceeding the calyx.—Native of Sicily and the south of France. A hardy annual, which we have had for near twenty years, springing up spontaneously, in a garden, so that it merits a place in Mr. Aiton's work, though of no attractive aspect, to procure it general notice. The *root* is small and fibrous. *Stems* several, branching at the very base only, from three to eight inches long, widely spreading or decumbent, simply racemose, round, slender, smooth. *Leaves* numerous, about the bottom of each stem, stalked, from one to two or three inches long, very obtuse; either simply obovate, entire, and partly wavy, or pinnatifid in a lyrate manner, sometimes rather deeply. *Flowers* extremely small, with a tawny and purplish tinge, succeeded by a long cluster of distant *Pods*, hardly an inch long, smooth, slightly unequal in their surface, each valve marked with a slender elevated line. This species, though very distinct, is so much akin to the last, that their characters are difficult to define. The *calyx* and *corolla* of the

present hardly answer indeed to the idea of a *Sisymbrium*, but rather to that of *Arabis*.

SECT. 4. *Leaves pinnate, or deeply pinnatifid*. Twenty species.

S. Sophia. Flix-weed. Linn. Sp. Pl. 920. Willd. n. 29. Fl. Brit. n. 7. Engl. Bot. t. 963. Mart. Rult. t. 57. Fl. Dan. t. 528. Pursh n. 4. (*Sophia chirurgorum*; Ger. Em. 1068. Lob. Ic. 738.)—Leaves doubly pinnate, with decurrent segments, a little hairy. *Petals* smaller than the calyx.—Native of waste ground, rubbish, and banks throughout Europe, from Sweden to Greece, flowering in summer. Mr. Pursh speaks of it as occurring by road-sides in Virginia, but rarely. We presume the seeds may have been imported from England. The *root* is annual. *Stem* about two feet high, erect, copiously clothed with finely divided spreading leaves, whose ultimate divisions are rather pinnatifid than pinnate. *Flowers* pale yellow, very small and inconspicuous, densely corymbose, succeeded by long clusters of slender, upright, torulose *Pods*, on slender, spreading, partial stalks, their valves separating and spreading from the base, somewhat like a *Cardamine*. The herb has been thought useful in fluxes.

S. millefolium. Mill-foil-leaved Wild-rocket. Willd. n. 28. Ait. n. 14. (*Sinapis millefolia*; Jacq. Coll. v. 1. 41. Ic. Rar. t. 127.)—Leaves triply pinnate, downy and hoary. *Petals* larger than the calyx.—Native of the Canary islands, from whence Mr. Masson brought it in 1779. This is a perennial, shrubby, greenhouse plant, flowering from May to September. Though like the last in general aspect, the leaves are more compound and hoary, with usually more rounded segments or leaflets; and the flowers are much more conspicuous, on account of their spreading yellow petals, double the length of the calyx.

S. Irio. London Wild-rocket. Linn. Sp. Pl. 921. Willd. n. 36. Fl. Brit. n. 8. Engl. Bot. t. 1631. Curt. Lond. fac. 5. t. 48. Jacq. Austr. t. 322. (*Erysimum latifolium majus glabrum*; Bauh. Pin. 101. Monf. sect. 3. t. 3. f. 3, at the bottom. *Irio lævis apulus*, erucæ folio; Column. Ecphr. 264. t. 265.)—Leaves runcinate, toothed, naked. *Stem* smooth. *Pods* erect, very long, thread-shaped.—Native of cultivated ground throughout Europe. Very common about London, where it was supposed by the sapient advocates of spontaneous generation, to have been generated in consequence of the great fire, in 1666. If, therefore, we confide in the bold assertion on the Monument, or the inscription on the fat boy at Pye-corner, this plant ought to be a cure for popery, or "the sin of gluttony," or for both. However this may be, the *root* is annual, the whole herb, except the upper flower-stalks and calyx occasionally, is invariably smooth, with an acrid flavour, like mustard. *Stem* erect, about two feet high, round, leafy, slightly zigzag, mostly branched. *Leaves* none of them truly pinnate, but deeply pinnatifid, with spreading or reflexed oblong lobes, most toothed at their upper or fore edge. *Flowers* corymbose, numerous, small, yellow; their petals spreading, longer than the calyx. *Pods* an inch and a half long, very slender, on partial stalks, about a quarter of an inch in length, all together composing a long lax cluster. *Stigma* sessile.

S. Loefelii. Loefel's Wild-rocket. Linn. Sp. Pl. 921. Willd. n. 38. Jacq. Austr. t. 324. (*Turritis Loefelii*; Br. in Ait. Hort. Kew. v. 4. 109. *Erysimum hirsutum*, filiquis erucæ; Loef. Prussl. 69. t. 14. *Rapistrum montanum*, irionis folio, macroleptoceron; Column. Ecphr. 266. t. 268.)—Leaves runcinate, toothed, hairy. *Stem* rough with deflexed bristles. *Pods* erect, thread-shaped, on long spreading stalks.—Native of Prussia, Austria, France,

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France, Italy, and Greece. More branched than the last, from which it differs in having the stem clothed with deflexed hairs, found more sparingly on the flower-stalks, which latter agree in length and slenderness with those of *S. Irio*. Nor do the leaves differ much in shape from that plant, though distinguished by their hairiness. The length and slenderness of the pods, in the Linnæan specimen, likewise accord with *Irio*; but in one from Jacquin they are shorter, as expressed in his plate. The stigma is sessile. There are, in the Linnæan and Banksian collections, specimens from Jacquin, of what he, at one time, seems to have confounded with his *S. Columnæ*, Fl. Austr. t. 323, as mentioned in Prodr. Fl. Græc. v. 2. 21. These specimens appear a smoothish variety of *S. Loefelii*, and bring this species very near to *Irio*. We now no longer feel any scruple respecting Columnæ's t. 268, cited indeed by Linnæus and Willdenow for *S. Loefelii*, though heedlessly by the latter for *S. Columnæ* also, after Jacquin, and though the hairs on the same do not point downward.

S. orientale. Oriental Wild-rocket. Linn. Sp. Pl. 921. Willd. n. 40. Ait. n. 40. Prodr. Fl. Græc. n. 1540. (*S. Columnæ*; Jacq. Austr. t. 323. Ait. n. 3.)—Leaves runcinate, downy. Stem without bristles. Pods erect, thread-shaped, on short, thick, spreading stalks.—Native of the Levant. Dr. Sibthorp had a wild specimen from Zante. According to Jacquin, this species also grows in Austria. The root is annual. Habit of the plant not unlike the two last, but the whole herbage is more or less densely clothed with fine close pubescence, and the partial stalks, supporting the pods, are much shorter and thicker than in either. The leaves of all three are pinnatifid, not pinnate: the upper ones are more lanceolate and entire in *S. orientale*, than in the others.

S. obtusangulum. Blunt-lobed Wild-rocket. Willd. n. 39. Schleich. Cat. 48. (Eruca, n. 459; Hall. Hist. v. 1. 199, excluding all the synonyms, except the following. *E. inodora*; Bauh. Hist. v. 2. 862.)—Leaves pinnate or pinnatifid, lyrate, with obtuse, deeply-toothed lobes. Stem rough with deflexed hairs. Pods erect, on long spreading stalks.—Native of various parts of Switzerland. We have specimens gathered by the late Mr. Davall near Aigle; where Haller indicates his variety γ , having larger and yellow flowers. We dare not answer for all his varieties, any more than for his very incorrect mass of synonyms, but our's is surely the plant of Schleicher and Willdenow. The root is annual. Stem two feet high, leafy, somewhat angular, clothed with more minute deflexed hairs than *S. Loefelii*. Leaves well compared by Haller to those of Common Ragwort, *Senecio Jacobææ*, as to their general aspect. They are often pinnate, not merely pinnatifid; their leaflets, or lobes, nearly uniform, remarkably blunt, most toothed backward. Flowers numerous, large, densely corymbose, on long stalks. Calyx hairy, spreading, as well as the petals.

S. catholicum. Notch-leaved Wild-rocket. Linn. Mant. 93. Willd. n. 43.—Leaves pinnate; leaflets elliptic-oblong, cut or serrated, smooth. Stem branched, spreading. Pods erect, on long spreading stalks.—Native of Spain and Portugal, to which the specific name alludes; but this is particularly unfortunate, for we have the same plant from Barbary. The root is woody, and apparently perennial. Stem bushy, not a foot high, leafy. Leaves stalked, smooth, fleshy, of about six or seven, opposite or alternate, leaflets, sharply serrated, and sometimes elegantly cut or pinnatifid, tapering at their base, each an inch long, more or less. Flowers yellow, half the size of *S. tenuifolium*, and situated like them on corymbose, finally racemose, long, terminal stalks. Linnæus, in his herbarium, has confounded a Stock-

holm specimen of this last-mentioned, in which the segments of the leaves happen to be jagged, with his real *catholicum*.

SECT. 5. Leaves oblong, scarcely divided. Nine species.
S. barbareæ. Plantain-leaved Wild-rocket. Linn. Sp. Pl. 921. Willd. n. 41. (*S. orientale*, *barbareæ* facie, *plantaginifolia*; Tourn. Cor. 16.)—Leaves simple; the upper ones ovate, toothed, elongated and clasping the stem at their base; radical ones somewhat heart-shaped, entire.—Native of the Levant. Linnæus had an incomplete specimen of this very rare plant from professor Burmann. Its general appearance is very like *Erysimum Barbareæ*. The whole herb is smooth, and said to be infipid. Stem stout, branched, angular and furrowed, leafy. Upper leaves gradually smaller, and more toothed. Flowers small, yellow, terminal, corymbose, rather numerous. We have ventured to remove this species from the last section, as the leaves cannot even be termed pinnatifid.

S. strictissimum. Spear-leaved Wild-rocket. Linn. Sp. Pl. 922. Willd. n. 46. Ait. n. 15. Prodr. Fl. Græc. n. 1542. Jacq. Austr. t. 194. (*Arabis a quibusdam dicta planta*; Camer. Epit. 342.)—Leaves ovato-lanceolate, toothed, downy, stalked. Corymbs panicle. Pods ascending.—Native of open, dry, mountainous situations, in Germany, Switzerland, and Italy. A hardy perennial, long known in our botanic gardens, flowering from June to August. The stems are a yard high, erect, round, or slightly angular, wand-like, clothed copiously with taper-pointed leaves, two or three inches long, dark-green, chiefly downy beneath, occasionally entire. Flowers very abundant and showy, of a golden yellow, in roundish, simple or compound, corymbose heads, on long stalks, collected at the upper part of the stem, into a dense oblong panicle. Pods racemose, two inches or more in length, slender, smooth, thread-shaped, two-edged, with a thick, nearly sessile, stigma.

S. hispanicum. Spanish Wild-rocket. Jacq. Coll. v. 1. 69. Ic. Rar. t. 124. Willd. n. 48.—Leaves lanceolate, sessile, smooth, with tooth-like serratures. Stem branched, spreading. Corymbs racemose. Pods close-pressed.—Native of Spain. Biennial; flowering in May and June, after being protected in the stove at Vienna through the winter. The whole herb is perfectly smooth, a foot and a half high. Leaves one or two inches long, bright green, rarely quite entire. Flowers deep yellow, smaller than the last, succeeded by long close clusters of crowded or imbricated pods, an inch in length.

S. integrifolium. Linear Siberian Wild-rocket. Linn. Sp. Pl. 922. Willd. n. 51. (*S. n. 38*; Gmel. Sib. v. 3. 270. t. 63.)—Leaves linear, entire. Flower-stalks hairy, glandular, and viscid. Pods spreading.—In mountainous sandy parts of Siberia. Gmelin. The root is slender, woody, supposed by Willdenow to be annual; but of this there is no certain account. Stem sometimes erect, sometimes procumbent, always hairy and glutinous, round, leafy, more or less branched. Leaves an inch and a half long, narrow, fleshy, obtuse, channelled, stalked, described by Gmelin as smooth, which they may perhaps usually be, but in his specimens before us they are clothed with longish scattered hairs. Flowers much larger than he delineates them, corymbose, purple or yellow, calyx hairy. Pods an inch long, linear, rather ascending, besprinkled, like their stalks, with prominent glands. Stigma very nearly sessile.

S. indicum. Indian Wild-rocket. Linn. Sp. Pl. 917. Mant. 93. Willd. n. 52. Burm. Ind. 140.—Leaves ovato-lanceolate, stalked, serrated, smooth; the lower ones somewhat lyrate. Stem zigzag, branched, spreading. Pods spreading, curved upwards.—Native of the East Indies. The

The Malay name on the Linnæan specimen is *Sasavi Sibina*, given by Burmann *Sesuri-china*. He describes the leaves as lyrate, of which we trace some indications on the specimen, and doubt not the lower ones are so. Linnæus has described this same specimen twice, not adverting to his *Sp. Pl.*, when he wrote the *Maniffa*; but both are sufficiently correct. The plant is annual, unknown in our gardens. Its affinity to *S. hispanicum*, induces us, with Willdenow, to place it in this section, rather than in the first, to which Linnæus first referred it; but not having seen the lower leaves, we cannot be positive. The stem is slender, smooth, and leafy. Flowers small, white, succeeded by long clusters of pods, each pod hardly an inch in length, nearly cylindrical, obscurely quadrangular, curved upwards, supported by a horizontal stalk, a quarter of an inch long. Stigma elevated on a short style. The pods have not the short turgid aspect proper to the first section of the genus, but accord precisely with the plants ranged in several of the latter sections, whose pods have more or less of a quadrangular shape, though two of the angles are often merely indicated by an elevated line along each valve.

Whoever shall take the trouble of tracing our remarks through this genus, and examining the other species, which, for brevity's sake, we have passed over, will see how much is still wanting towards a correct generic distribution of the whole order. Mr. Brown's, in *Hort. Kew.*, is, notwithstanding, an able and useful attempt at a reform, of which we may say more hereafter under the article TETRADYNAMIA. See also SILIQUOSÆ and SILICULOSÆ.

Sisymbrium, among the Romans, was one of the ingredients, of which the nuptial garlands were composed.

SISYMBRIUM, in *Gardening*, contains a plant of the hardy herbaceous kind, of which the species cultivated is the common water-crefs (*S. nasturtium*).

Method of Culture.—This may be effected by parting the roots, or by seed. In the first method, while the plants are young, a quantity of slips should be made with root-fibres to them, and be planted out immediately in a shallow, trickling, watery situation, when they will readily strike roots, feed, and increase themselves.

The seed should be collected during the summer season, and sown in the same places; or, which is better, the plants, with the ripened seeds upon them, be thrown into them, where they will strike root, and shed their seeds for future increase.

These plants are in much esteem as winter and spring salad herbs.

SISYMBRIUM *Nasturtium*, *Water-Cresses*, in the *Materia Medica*. The leaves of the water-creffes have a moderately pungent taste, and emit a quick penetrating smell, like that of mustard-seed, but much weaker. Their pungent matter is taken up both by watery and spirituous menstrua, and accompanies the aqueous juice, which issues copiously upon expression: it is very volatile, so as to arise, in great part, in distillation, with rectified spirit, as well as with water, and almost totally to exhale in drying the leaves, or inspissating by the gentlest heat to the consistence of an extract, either the expressed juice, or the watery or spirituous tinctures. Both the inspissated juice, and the watery extract, discover to the taste a saline impregnation, and in keeping throw up crystalline efflorescences to the surface. On distilling considerable quantities of the herb with water, a small proportion of a subtile, volatile, very pungent oil is obtained.

Water-creffes obtain a place in the materia medica for their antiscorbutic qualities, which have been long very generally acknowledged by physicians. They are also sup-

posed to purify the blood and humours, and to open visceral obstructions; they are nearly allied to scurvy-grafs, but are more mild and pleasant, and for this reason are frequently eaten as salad. In the pharmacopeias the juice of this plant is directed with that of scurvy-grafs and Seville oranges; and Dr. Cullen has remarked, that the addition of acids renders the juices of the plantæ siliquosæ most certainly effectual, by determining them more powerfully to an acceftent fermentation. Lewis Mat. Med. Woodville Med. Bot.

SISYMBRIUM is also a name used to express the wild water-mint. See MINT.

SISYRA, among the *Ancients*, a woolly skin used for a covering to beds.

SISYRINCHIUM, in *Botany*, from *συσ*, a bag, and *ῥιγχος*, a snout, the name of a bulb, mentioned by Pliny amongst other bulbs, under various Greek denominations. He relates, after Theophrastus, book vii. chap. 13. that it is remarkable for increasing, during winter, in the lower part, which in spring becomes contracted, and the upper part is then eatable. Nobody has ascertained the real *συσῤῥιχιον* of Theophrastus or Pliny. Botanists have applied this appellation according to their fancy, without even pretending to ascertain whether it alludes to the fondness of swine for the root, or to any resemblance in its figure to their snout. The *Sisyrrinchium* of Columna, *Ecpbr.* 328. t. 327, is *Ixia Bulbocodium*, in whose minute bulb that fanciful author traces such a resemblance. That of Bauhin and Tournefort is *Iris Sisyrrinchium* of Linnæus, a common Greek plant, whose bulb increases at its summit, and is eatable. The name is now retained for a modern genus, of the same natural order indeed, but otherwise having nothing in common with the plant of the ancients.—Linn. Gen. 465. Schreb. 450. Willd. Sp. Pl. v. 3. 577. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 4. 135. Gawler (Ker) in Sims and Kou. Ann. of Bot. v. 1. 246. Pursh 31. Cavan. Diff. 344. Juss. 57. Lamarck Illustr. t. 569. (Bermudiana; Tourn. t. 208. Gærtn. t. 11.)—Class and order, *Monadelphia Triandria*. (*Gynandria Triandria*, Linn.) Nat. Ord. *Enfate*, Linn. *Irides*, Juss.

Gen. Ch. *Common Sheath* two-edged, of two compressed, pointed valves; *partial* ones several, lanceolate, concave, obtuse, inferior, single-flowered. Perianth none. *Cor.* superior, of six nearly equal, flattish, obovate, minutely pointed petals, spreading in their upper half; the three alternate exterior ones a little the broadest. *Stam.* Filaments three, united half way up, or more, into an obscurely triangular tube, shorter than the corolla, their extremities spreading; anthers incumbent, roundish. *Pistl.* Germen inferior to the corolla, obovate; style triangular, the length of the tube; stigmas three, erect, scarcely tumid, undivided, notched. *Peric.* Capsule obovate, rounded, with three slight angles, of three cells, and three valves; the partitions from the centre of each valve. *Seeds* numerous, roundish, inserted in two rows, into each of the partitions.

Ess. Ch. *Common sheath* of two or more leaves. Calyx none. Petals six, nearly equal, flat. Style one. Capsule of three cells, inferior.

1. *S. latifolium*. Broad-leaved Sisyrrinchium. Swartz Prodr. 17. Ait. n. 1. (*S. palmifolium*; Cavan. Diff. 348. t. 191. f. 1. *Moræa plicata*; Willd. Sp. Pl. v. 1. 243. *M. palmifolia*; Jacq. Ic. Rar. t. 227. Coll. v. 3. 192. *Marica plicata*; Curt. Mag. t. 655. Bermudiana palmæ folio, radice bulbosâ; Plum. Ic. 35. t. 46. f. 2.)—Stalk round. Sheath many-flowered. Leaves lanceolate, plaited. Native of the West Indies. Cultivated by Miller in 1737. It requires the heat of a stove, flowering from June

SISYRINCHIUM.

June to August. The *root* is an ovate bulb, with numerous, very thick and fleshy, fibres. *Leaves* radical, stalked, erect, from one to two feet long, taper-pointed, smooth, dark-green, with many longitudinal parallel ribs and plaits. *Stalk* solitary, taller than the leaves, very smooth and round, bent obliquely, and horizontally at the top, where it bears several white, inodorous, short-lived *flowers*, hardly an inch broad, accompanied by one small erect leaf. *Antbers* yellow. Linnæus unaccountably confounded this with his true *S. palmifolium*, hereafter described.

2. *S. elegans*. Yellow Green-spotted Sisyrrinchium. Willd. n. 1. (Moræa elegans; Jacq. Hort. Schoenbr. v. 1. 6. t. 12.)—*Stalk* round, simple, sheathed, single-flowered, shorter than the solitary, linear, decumbent, radical leaf. *Petals* oblong, acute.—Native of the Cape of Good Hope; flowering in a greenhouse in May. *Bulbs* the size of hazel-nuts, each bearing a long, narrow, decumbent, ribbed, green leaf, and an erect *stalk*, about a span high, clothed with many large, alternate, sheathing, rather tumid, *bractæas*. The solitary terminal *flower* is full two inches broad, of a bright yellow; the disk of each of the three outer *petals* marked with a broad green spot, highly ornamental. This and the following have not the true compressed bivalve *sheath* of the genus.

3. *S. collinum*. Tawny Sisyrrinchium. Cavan. Dill. 346. Willd. n. 2. Redout. Liliac. t. 250. (Moræa collina; Thunb. Moræa n. 13. Prodr. 11. Jacq. Ic. Rar. t. 226.)—*Stalk* round, sheathed, somewhat branched, shorter than its linear, pointed, ascending leaf. *Petals* oblong, acute. Plentiful on hills at the Cape of Good Hope. Taller than the last, with a branched *stalk*, bearing about three *flowers*, either of a tawny blush-colour, or pale buff, unspotted. The *leaf*, which grows from the lower part of the stalk, stands erect, its point drooping over the uppermost flower.

4. *S. grandiflorum*. Large-flowered Sisyrrinchium. Cavan. Dill. 346. t. 192. f. 2. Willd. n. 3.—*Stalk* round, simple, leafy. *Sheath* with about three flowers. *Petals* obtuse, pointless. *Leaves* lanceolate, plaited. Native of Peru. *Bulb* ovate, an inch long, with capillary fibres. *Stem* a foot high, jointed, bearing three or four stalked *leaves*, from three to ten inches in length. *Flowers* an inch and a half broad, with obovate *petals*, yellow in the dried specimen. Column of the *stamens* measuring near an inch. *Cavanilles*.

5. *S. Bermudiana*. Iris-leaved Sisyrrinchium. Linn. Sp. Pl. 1353, β. Willd. n. 4. Ait. n. 2. Cavan. Dill. 346. t. 192. f. 1. Mill. Illustr. t. 73. Redout. Liliac. t. 149. (*S. iridioides*; Curt. Mag. t. 94. Bermudiana iridis folio, radice fibrosa; Dill. Elth. 48. t. 41. f. 48.)—*Stalk* two-edged, branched, leafy. *Sheath* shorter than its four flowers. *Petals* pointed. *Leaves* sword-shaped.—Native of the Bermuda islands. Common in our stoves or greenhouses since the time of Dillenius, flowering in summer. The *root* is fibrous, perennial. *Plant* erect, about a foot high, smooth, with a narrow compressed *stem* and *leaves*. *Flowers* numerous, an inch wide, dark blue, pale green in the centre, on slender partial stalks.

6. *S. anceps*. Narrow-leaved Sisyrrinchium. Cavan. Dill. 345. t. 190. f. 2. Willd. n. 5. Ait. n. 3. Pursh n. 2. (*S. Bermudiana*; Linn. Sp. Pl. 1353, α. *S. gramineum*; Curt. Mag. t. 464. Redout. Liliac. t. 282. Bermudiana graminea, flore minore cæruleo; Dill. Elth. 49. t. 41. f. 49.)—*Stalk* two edged, winged, unbranched, nearly leafless. *Sheath* unequal, longer than its four flowers. *Petals* pointed. *Leaves* sword-shaped.—Native of North America. On dry hills and grass-plats; from Canada to Carolina, flowering in July and August. *Pursh*.

Hardy in our gardens, but seldom preserved, the *flowers* being so much smaller and less conspicuous than the former. The whole *plant* is about half the size of that species, of a grassy aspect; the *root* crowned with numerous fibres, from the decayed foliage of former seasons.

7. *S. mucronatum*. Pointed-sheathed Sisyrrinchium. Michaux Boreal-Amer. v. 2. 33. Pursh n. 1.—*Stalk* unbranched, somewhat fetaceous as well as the leaves. *Sheath* coloured; one valve ending in a long point. In wet meadows of short grass, in Pennsylvania and Virginia, flowering in June and July. Perennial. *Flowers* of a beautiful blue, smaller than the last. *Pursh*. The lower part of the *leaves* and the *sheaths* are purple. *Micbaux*.

8. *S. micranthum*. Small-flowered Sisyrrinchium. Cavan. Dill. 345. t. 191. f. 2. Willd. n. 6.—*Stalk* two-edged, branched, leafy. *Sheath* about equal to its two or three flowers. *Petals* linear, pointed. *Leaves* channelled.—Gathered by Joseph de Jussieu in Peru.—*Root* fibrous. Whole *plant* but three inches high. *Leaves* several, linear, pointed, concave or channelled, sheathing, shorter than the item. *Sheath* somewhat unequal. *Flowers* very small, on capillary stalks.

9. *S. californicum*. Yellow Unbranched Sisyrrinchium. Ait. n. 4. (Marica californica; Ker in Curt. Mag. t. 983.)—*Stalk* two-edged, winged, unbranched. *Petals* obovate, pointless. *Leaves* linear-sword-shaped.—Discovered on the coast of California, by Mr. Archibald Menzies, who brought seeds to England, in 1796. It proves a hardy greenhouse perennial plant, flowering in summer and autumn, and readily propagated, either by seed or parting the roots, which, like those of perhaps all the indubitable species of this genus, unfortunately for the origin of its name, are fibrous. The *stalk* is about two feet high, being taller than the *leaves*, though nearly the same breadth, and bears but one tuft of numerous *flowers*, from a close *sheath*, one of whose valves rises somewhat above them. The *corolla*, *stamens*, and *style*, are of an uniform bright yellow. Mr. Ker remarks, that the *filaments* are combined in their lower part only.

10. *S. convolutum*. Yellow Branched Sisyrrinchium. Redout. Liliac. t. 47.—*Stalk* two-edged, branched, leafy. *Petals* ovate, scarcely pointed. *Leaves* linear-sword-shaped.—Said to be a native of the Cape of Good Hope, but for this M. Redouté had no certain authority. It was sent from Italy to the Paris gardens, and we should not be greatly surpris'd, if future enquiries should prove it of American origin. There seems very little difference between this species and the last, except its more humble growth, and the *stem* being divided or branched, and leafy. Redouté has erroneously defined the latter as round, which is corrected in his fifth volume, at t. 275. The name alludes to the rolling in of the *petals* as they fade, which is also the case in *californicum*, and many, if not all, of the other species.

11. *S. tenuifolium*. Yellow Slender-leaved Sisyrrinchium. Redout. Liliac. t. 275.—*Stalk* compressed, branched, spreading. *Petals* ovate, acute. *Leaves* linear-awl-shaped. *Germs* hispid.—Communicated to the Paris garden by M. Zea, a celebrated Spanish botanist; so that we presume the plant to be a native of Mexico or Peru, though nothing has been made known as to its origin. This species agrees with the last in its yellow *flowers*, which however appear to be rather more numerous, sometimes six, in each *sheath*. The *stem* and *leaves* are much more slender, and hardly so tall; the former twice-branched, in a spreading manner, the *branches* curved upwards, with an erect leaf or two at each subdivision. The *germen* is remarkable

for being rough with little glandular hairs, which fall off as the capsule ripens. These have not been noticed in any other species.

12. *S. ixioides*. White New Zealand Sifyrinchium. Forst. Prodr. 61. (Ferraria ixioides; Willd. Sp. Pl. v. 3. 582. *Morea* ixioides; Thunb. *Moræa* n. 7.)—Stalk triangular, branched. Leaves linear, with cartilaginous edges. Outer petals half the size of the inner.—Gathered in New Zealand, by Forster, whose specimens are before us. The root is woody, furnished with very long, tough, zigzag fibres. Stalks a span high, nearly leafless, branched in the upper part. Leaves shorter than the stalks, erect, flat, linear, a quarter of an inch wide, strongly striated, with a pale cartilaginous edge, but not sword-shaped, as they have no prominence or rib in the middle; their bases are sheathing, or equitant. Partial flower-stalks rigid, widely spreading, two, three, or four together, with very small lanceolate sheaths at their origin. Flowers about half an inch broad, white, their three outer petals somewhat coloured, if we may judge from the dried specimen. Germen smooth. The specimens Thunberg saw were taller than our's. The inequality of the petals probably led Willdenow to make this plant a *Ferraria*; but it wants the genuine character of that genus, the jagged and curled corolla, and has altogether the habit of a true *Sifyrinchium*.

13. *S. palmifolium*. Palm-leaved Sifyrinchium. Linn. Mant. 122, excluding the synonym. Willd. n. 7. Ait. n. 5? (*Moræa palmifolia*; Thunb. *Moræa* n. 6.)—Stalk two-edged, winged, densely corymbose at the summit. Leaves sword-shaped, strongly ribbed.—Gathered in Brasil, by father Panegai, who sent it, with many other new plants, to professor Arduino of Padua, by whom they were transmitted to Linnæus. The present has all the appearance of a true *Sifyrinchium*, with a fibrous perennial root. The stem is two feet high, erect, unbranched, naked, with two opposite leafy wings. Leaves equitant, erect, shorter than the stem, three-quarters of an inch wide, having about five principal ribs in the middle part, and a few finer ones towards the edges. Flowers very numerous, in a dense, corymbose, compound, terminal panicle, two or three inches high, accompanied by one erect ribbed leaf, about the same height. Bractæas and sheaths near an inch long, ovate, pointed, striated, concave, membranous at the edges. Flowers apparently pale, with numerous dark or purplish veins; their partial stalks longer than the sheaths. Germen roundish, smooth. We are unable to account for the flowers having been termed *spiked*, unless Thunberg has confounded any thing else with this rare species. Linnæus says the style is three-cleft more than half way down.

14. *S. striatum*. Yellow Striated Sifyrinchium. Sm. Ic. Pi&t. t. 9. Willd. n. 8. Ait. n. 6. Redout. Liliac. t. 66. (*S. fipicatum*; Cavan. Ic. v. 2. 2. t. 104. *Morea* fertata; Jacq. Hort. Schoenbr. v. 1. 6. t. 11. *Marica* striata; Ker in Curt. Mag. t. 701.)—Stem much branched, leafy, compressed, winged, many-flowered. Flowers fasciculated, with a simple sheath to each.—Native of Mexico; a hardy perennial in our gardens, propagating itself spontaneously by seed. The root is fibrous, tufted. Stems several, two or three feet high, accompanied by copious, equitant, sword-shaped, striated, glaucous leaves, edged with purple, and tinged with saffron-colour at their base. Flowers very numerous, inodorous, forming tufts along the branches, as if whorled, each tuft accompanied by a large concave simple bractæa, and each of the numerous partial stalks attended by a simple membranous sheath. Corolla above an inch wide, expanding in sunshine only, when the flowers make a handsome appearance, lasting in

succession through most part of the summer. Petals obtuse with a point, slightly cohering at the base, into the form of a bell, yellow and more or less spotted within; their upper part widely spreading, pale yellow above, striated with purple veins beneath. Germen roundish, smooth. Capsule the size of a black currant, gibbous. It will be perceived that the sheaths of this species do not exactly answer to the generic character, yet nothing can be a more genuine *Sifyrinchium*. Much has been done to discriminate the genera of this order, and great improvements have been made, but much is still wanting.

SISYRINCHIUM, in Gardening, contains plants of the flowery perennial kind, of which the species cultivated are, the Iris-leaved sifyrinchium (*S. bermudiana*); and the narrow-leaved sifyrinchium (*S. anceps*).

It is observed, that the leaves, stalks, and flowers of the first sort are three times as large as in the second, and the sheath incloses six or seven flowers; whereas the second has rarely more than two, and these expand only for a short time in the morning, while, in the former, they continue open the whole day.

Method of Culture.—These plants may be increased by seeds and parting the roots: in the former method, the seeds of the first sort should be sown in the autumn, as soon as they become ripe, on a border which has an eastern aspect, in drills at three or four inches distance, covering them about half an inch with fine mould; they should afterwards be kept clean from weeds with care. They succeed best in a loamy soil in a shady situation, and where the ground has not been manured. But in the latter sort the seeds should be sown in pots, in order that they be protected in the greenhouse, or by some other means.

The first kind affords ornament in the large open borders and clumps of pleasure-grounds, and the latter among other green-house plants of the same growth.

SISZEK, in Geography, a town of Croatia, at the conflux of the rivers Save and Kulpa, fortified with a wall and moat; captured by the Turks in 1593, and burned by them in 1594, but rebuilt by the Hungarians; 48 miles S. of Varasdin. N. lat. 45° 38'. E. long. 16° 44'.

SIT, an island in the Adriatic. N. lat. 4° 14'. E. long. 15° 24'.

SITA, in Hindoo Mythology, is a celebrated incarnation of the goddess Lakshmi, celestial consort of Vishnu, in his avatara, or descent in the form of Rama. In the language of Hindoo fable, she was his *fakti*, or energy; and numberless poems have been written in honour of her beauty, merits, and deeds. She is one of the most popular goddesses of the Hindoo Pantheon, and is indeed one of the most virtuous and interesting characters in their puranic or heroic legends. Her history and that of her lord forms the subject of the Ramayana, which epic poem, like the Iliad, is grounded on a rape. (See RAMAYANA.) As noticed in that article, and RAVENA, the carrying off, by the treachery of the tyrant of that name, the virtuous spouse of Rama, roused that hero to the mighty deeds necessary for her rescue from the hands of her powerful persecutor, and celebrated in the fine poem of Valmiki; and, as noticed above, in numberless others of secondary and minor fame.

The outline of Sita's history is this. The childless raja Janaka, (see JANAKA,) having duly propitiated the gods, was led to the benevolent adoption of a female child about five years old, found inclosed in a box by a Brahman in a field. She was called Sita, from *sit* or *set*, meaning a furrow or field; and Janeki, after her adoptive father. Sita, however, means also *fair*, and may be thence derived, and is in this sense, of denoting beauty, given also to Parvati and Sarafwati, consorts

forts of the other two divine persons of the Hindoo triad. She proved to be an incarnation of Lakshmi, as before noticed; and on attaining maturity was won by Rama, in a contest of archery with many sovereigns, ambitious of obtaining a prize of such incomparable beauty. This story, as it is related in the Ramayana, reminds us of the unyielding bow of Ulysses; as none but Rama had power to accomplish the required and ordained feat; which was piercing the eye of a fish whirling on a pin fixed on a high pole; and not looking at the mark, but at its reflection in a vessel of oil placed on the ground. The ten-headed-twenty-handed tyrant Ravana had previously failed. See RAVENA.

Burning with the rage of disappointed desire, the tyrant carried her off; and having been in his power, her purity might be possibly suspected; she therefore plunged into the flames, where, defended by Pavaka, the regent of fire, her incomcombustibility attested her innocence. She was of course triumphantly restored to her overjoyed husband. In the Ramayana she is described as "endued with youth, beauty, goodness, sweetness, and prudence; an inseparable attendant on her lord, as the light on the moon; the beloved spouse of Rama, dear as his own soul; formed by divine illusion, amiable, and adorned with every charm;" and always held forth as an example of conjugal faith and affection.

While confined on the island of Lanka, or Ceylon, (see those articles,) and persecuted by the address of its tyrannical sovereign, the anguish and lamentation of Sita are copious subjects of hyperbole for Hindoo poets. Travellers are still shewn a lake or pool, called Sita-koonda, said to have originated in the floods of tears shed by the captive beauty. This extravaganza was not lost on our early missionaries and travellers. Ceylon being with them the garden of Eden, they find Adam's peak, Adam's bridge, &c. called Rama's by the natives. Eve personates Sita, in respect to this pool. Sir John Mandeville notices it in his quaint way. Describing Ceylon, he has fair scope for his poetical exuberance. "In that isle is a gret mountayne, and in mydd place of the mount is a gret lake in a full fayre pleyne, and there is gret plentie of watre. And thei of the contrie feyn that Adam and Eve wepten upon that mount 100 zeer, when they weren dryven out of Paradys. And that watre thei feyn is of here teres; for soe much watre they wepten that made the forefede lake." Sir John died in 1372. See MANDEVILLE.

A beautiful tree, called Afoka by Sanscrit botanists, bears a mythological reference to the above fable of Sita. She was confined in a grove of those trees, whose name is derived from grief, or lamentation. It is hence, perhaps, also sacred to the god of tears, or the avenging Siva. (See SIVA.) Afoka, indeed, rather from its privative initial, denotes the absence of grief, equivalent to grief-dispeller; thus named possibly from its beauty, so greatly admired by a poetical and tasteful people.

A numerous sect of Hindoos adore Sita as Lakshmi herself. It is a branch of the sect of Ramanuj. (See that article, and SECTS of Hindoos, for an account of their peculiarities.) Under the article SAKTI will be found farther thereon. She is said to have borne Rama two sons, Kushi and Lava, who were great orators and minstrels; but they are seldom heard of, except in legends immediately relating to their family.

In our article RAMA we have noticed a Peruvian festival, called Ramafitza, which, as well as in name (Rama-Sita), remind us of usages still common among Hindoos. Those disposed to lay stress on etymological coincidences, may, perhaps, here also find the source of the much disputed sense of the word *Parasiti*. (See Potter's *Archæol. Græc.* b. ii.

c. iii.) This was the name of an order of men among the Greeks, whose office seems originally to have been the gathering from the husbandmen the corn allotted for public sacrifices. Para and Sita are names, in fact, of all the three principal Hindoo goddesses, Lakshmi, Parvati, and Saraswati (see those articles, and PARA,) and may be said to mean *first* and *fairest*, as well as *first field* or *fruits*. To all these, corn and other first-fruits of the field are appropriate offerings; the gathering and care of which might give the priests the name of Parasiti. The common appropriation of these tithes to their own uses would naturally in time degrade them and their name in the estimation of their flock, who, detecting the impostures of priestcraft, brought them to their proper level in the sense of the thence derived word Parasite. See that article.

SITACA, or SITACE, in *Ancient Geography*, a large and well-peopled town of Asia, in the Perside, near Babylon, and 15 stadia from the Tigris, according to Xenophon. This town was situated nearly at an equal distance from the Tigris and the Euphrates, N.W. of Seleucia.

SITACAS, a river of Asia, in the Perside, which runs into the Persian gulf, about 800 stadia beyond the mount Areon, according to Nearchus.

SITALA, in *Geography*, a river of Mexico, which runs into the Pacific ocean, N. lat. 17° 38'. W. long. 101° 40'.

SITANG, a river of Hindoostan, one of the branches of the river called Pegu, which runs into the bay of Bengal.

SITANTA, the name of a fabulous mountain, in which is described the terrestrial abode of the god Indra, the Hindoo regent of the firmament. (See INDRA.) In the Hindoo Pantheon, the wonderful mountain Meru is described from the Puranas. (See MERU.) On one of its three peaks is Kailasa, the Olympus of Siva; and on another is the Swerga, or paradise of Indra. But his terrestrial abode is on Sitanta, a part probably of Meru; and it may be amusing to see in what the delights of Hindoo gods are supposed, by their sacred writers, to consist. Sitanta is "skirted by a most delightful country, well watered, and enlivened by the harmonious noise of the black bee and frogs. There, among immense caves, is the Kridavana, or place of dalliance of Mahendra; where knowledge and the completion of our wishes are fully acknowledged. There is the great forest of the Pariyateka-tree of the king of the gods, known through the three worlds; and the whole world sings his praise from the Veda. Such is the place of dalliance of him with a thousand eyes, or Indra. In this charming grove of Sakra, or Indra, the gods, the danavas, the snakes, yakshas, rakshas, guhyas or kuveras, gandharvas, live happy; as well as numerous tribes of Uplara, fond of sport." P. 270. The Gandharvas are celestial female choristers.

The abode of Vishnu is usually called *Vaikontha*; which see, and SWERGA.

SITAWACA, in *Geography*, a town of the island of Ceylon; 44 miles S.S.W. of Candy.

SITCA, a Russian settlement on the N.W. coast of America, somewhat S. of Cadiack, or Kadiak, in the interior of that deep bay to which Vancouver gave the name of Norfolk's found. The savages in this quarter are of a more lively and ferocious character than those of Cadiack. Instead of dozing on the ridges of their houses, they sing and dance perpetually; and are both brave and expert in the use of fire-arms, with which they are supplied by the American traders, who occasionally resort to that coast. They killed five or six of M. Lifsansky's men, in a gallant defence of a kind of rude fort, from which that commander chose to expel them, that the agents of the Russian Company might occupy the spot as a factory. After cannonading it all day,

it was found next morning that the natives had deserted it in the night; and when M. Lifsansky went to take possession, he was not a little shocked "to find, as in a second massacre of innocents, numbers of young children lying together murdered! left their cries, if they had been carried along with them, might have led to a discovery of the flight of their cruel parents;—a number of dogs had been butchered for the same reason." They burn their dead, and massacre their prisoners. They are extremely muscular and hardy; and apparently quite insensible to pain. One lad, who frequently visited the navigators, and stole whatever he could lay his hands on, was at last threatened with the scourge, but absolutely laughed at the menace,—and continued his derision and gaiety when under the most rigorous discipline that a Russian flagellator could apply. They are great beaux withal;—paint their faces of various colours, and work up their hair with a red paste, and then powder it in a magnificent manner with the fine white down of the sea-ducks. Their country is obviously volcanic. M. Lifsansky climbed up the highest mountain on the coast, which Vancouver distinguished by the name of Mount Edgcombe, and found the summit formed into a huge crater, nearly two miles in circuit, and about three hundred feet deep. It was partly filled with snow; and there is no tradition of the volcano having been seen in a state of activity. The height he estimated at no less than 8000 feet.

We shall here subjoin, from the work now before us, some account of the other settlement called *Cadiack*. This is a large barren island, at the eastern extremity of the Aleutian chain; inhabited by about 4000 of the most filthy and stupid savages of which we have any where an account. They are almost all covered over with itch and ulcers; and are extremely indolent and torpid. "Their favourite recreation," says M. Lifsansky, "after sleeping, is to sit on the roofs of their houses, or on the beach, for hours together, looking at the sea, and observing a profound silence, for they never converse; and I am persuaded," adds the worthy Muscovite, "that the simplicity of their character exceeds that of any other people." Their great passion is for snuff and amber; and their chief occupation catching whales,—on the blubber of which they fatten luxuriously, in a favourable season. They have a strange superstition, which leads them to believe that the possession of the dead bodies of any old or famous fishers contributes essentially to their good luck; and accordingly shew considerable sagacity in hunting them up in the caverns and other secret places where they have been flowed by their relations. Some, says M. Lifsansky, have actually accumulated a treasury of not fewer than twenty such corpses.

M. Lifsansky observes, that the volcanic energy seems to be more entire in this than in any other region of the world. In the neighbourhood of Oonalashka, which is situated about the centre of the Aleutian chain, a new island, nearly twenty miles in circumference, has been formed within these twenty years. The following is the account of it, which M. Lifsansky collected from eye-witnesses at Cadiack.

"In the evening of the 26th, while I was alone, writing the memorandums of my journal, a Russian introduced himself, who had resided on the island of Oonalashka, when a new island started up in its vicinity. I had heard of this phenomenon, and was therefore desirous to learn what he knew respecting it. He said, that about the middle of April 1797, a small island was seen where no island had been seen before. That the first intimation of its appearance had been brought by some Aleutians to Captain's Harbour, who, returning from fishing, observed a great smoke issuing out of the sea; that this was the smoke of the volcano, which was then gra-

dually rising above the surface of the sea, and which in May, 1798, burst forth with a blaze, that was distinctly seen from a settlement called Macooshino, on the island of Oonalashka, at the distance of no less than forty miles in the north-west. This new island is tolerably high, and about twenty miles in circumference. It has been remarked, that it has not increased in size since the year 1799; and that no alteration has taken place in its appearance, except that some of the highest points have been thrown down by violent eruptions." See Lifsansky's Voyage round the World, in the Years 1803, 4, 5, and 6, performed by Order of His Imperial Majesty Alexander I. Emperor of Russia, &c. 4to. London, 1814.

SITCHEVSK, a town of Russia, in the government of Smolensk; 96 miles E.N.E. of Smolensk. N. lat. 55° 34'. E. long. 34° 44'.

SI-TCHUA, a town of the kingdom of Corea; 33 miles N. of Han-tcheou.

SI-TCHUEN, a town of China, of the third rank, in Ho-nan; 55 miles W. of Nan-yang.

SI TE *fecerit securum*, in *Law*, a species of original writ, called peremptory, which directs the sheriff to cause the defendant to appear in court, without any option given him, provided the plaintiff gives the sheriff security effectually to prosecute his claim. This writ is in use, where nothing is specifically demanded, but only satisfaction in general; to obtain which, and minister complete redress, the intervention of some judicature is necessary. Such are writs of trespass, or on the case, in which no debt, or other specific thing, is sued for in certain, but only damages to be assessed by a jury. See PRÆCIPE.

SITE, or SCITE, *Situs*, denotes the situation of a house, messuage, &c. And sometimes the ground-plot, or spot of earth on which it stands.

SITES of *Homefalls, Yards*, &c. the situations proper for them in different cases. These are very various, according to the nature and kind of the farms for which they are designed, as whether they are those of the sheep, the grazing, the dairying, the hay and grass, or those of the mixed, arable, and grass fort. In each kind there is a great number of different suitable requisites to be provided, which must, in a great measure, depend upon the site itself. See FARM-YARD, and YARD.

SITE, *Situs*, in *Logic*, one of the predicaments, declaring a subject to be so and so placed.

SITENSKOI, in *Geography*, a town of Russia, in the government of Novgorod, near the Ilmen; 20 miles W.S.W. of Kretzei.

SITHA, a town of Hindoostan, in Guzerat; 75 miles N.N.E. of Junagur.

SITHCUNDMAN, in our *Old Writers*, one whose province it was to lead the men of a town or parish. Leg. Inc. cap. 56.

Dugdale says, that in Warwickshire the hundreds were formerly called *sythesoca*, and that *sithesocundman*, and *sithcundman*, was the chief officer within such a division, *i. e.* the high-constable of the hundred.

SITHE. See SCYTHIE.

SITHESOCA, in our *Old Writers*, is used to denote the district now called a *hundred*. The word is Saxon, signifying a *franchise*, or *liberty*.

SITHON, in *Ancient Geography*, a mountain of Thrace.—Also, an island of the Ægean sea.

SITHONIA, a part of Thrace, on the Toronæan gulf, in which were the towns of Torone, Galepfus, Sarmyles, Meczyberie, and Olymbe.

SITHONII,

SITHONII, a people of Thrace, near the Euxine sea, among whom Orpheus was born.

SITIA, a town of Spain, which had a voice in the assembly of Cordova.

SITICINES, among the Romans, persons who founded a kind of trumpet, having a very mournful tone, at the burying of the dead.

SITJES, in *Geography*, a town of Spain, in the province of Catalonia; 12 miles S.W. of Barcelona.

SITIFIS, in *Ancient Geography*, a town of Mauritania Cæsariensis, which became the capital of one of the Mauritanias, to which it gave name. See **SITIPHA**.

SITIGNAK, in *Geography*, one of the Fox islands, in the North Pacific ocean. N. lat. 53° 30'. E. long. 117° 14'.

SITINACUR, a town of Hindoostan, in Tellingana; 6 miles N. of Indelavoy.

SITIPHA, or **SITIFI Colonia, Settaf**, in *Ancient Geography*, a town of Africa, and the metropolis of Mauritania Sitifensis. It was situated in the interior of the country towards the S.E. of Saldæ.

SITIOGOGUS, a river of Asia, in the Perside, which ran into the Persian gulf.

SITODIUM, in *Botany*, Gærtn. v. 1. 344. t. 71, 72, a name originally applied to the genus affording the celebrated bread-fruit, by sir Joseph Banks and Dr. Solander, and derived from *σιτος*, bread, food, or provision. This name has given way to **ARTOCARPUS**; see that article, and **RADERMACHIA**.

SITOMAGUM, or **SITOMAGUS**, in *Ancient Geography*, a town of the isle of Albion, in the country of the Iceni, between Cambretonium and Venta Icenorum, according to Antonine's Itinerary.

SITON, a town of Greece, in Thessaly.

SITONÆ, *Σιτωναι*, among the Athenians, officers appointed to lay in corn for the use of the city, for which purpose the *ταμιας τῆς διοικησεως*, or the public treasurer, was to furnish them with as much money as they had occasion for. Potter, *Archæol. Græc. lib. i. cap. 15. tom. i. p. 83.*

SITONE, in *Ancient Geography*, a town of Macedonia, in the vicinity of mount Athos.

SITONES, the name of one of the three principal classes of people who inhabited Scandinavia, beyond mount Savos, and bounded by the sea to the west and the south.

SITOPHYLAX, *Σιτοφυλαξ*, formed from *σιτος*, corn, and *φυλαξ*, keeper, in *Antiquity*, an Athenian magistrate, who had the superintendance of the corn; and was to take care that nobody bought more than was necessary for the provision of his family.

By the Attic laws, particular persons were prohibited buying more than fifty measures of wheat a man; of those measures, we mean, called *φορμαι*, and the sitophylax was to look to the observation of this law. It was a capital crime to prevaricate in it.

There were fifteen of these sitophylaces; ten for the city, and five for the Piræus.

SITORE, in *Geography*, a town of Hindoostan, in the province of Tinevelly; 10 miles N. of Palamcotta.

SITPOUR, a town of Hindoostan, in the subah of Moultan, on the Indus; 30 miles N.W. of Moultan.

SITRIGALLY, a town of Hindoostan, in Myfore; 34 miles N.N.E. of Chitteldroog.

SITTA, the *Nuthatch*, in *Ornithology*, a genus of birds of the order Picæ, of which the generic character is, Bill tubulate, roundish, straight, entire; the upper mandible is a little longer, compressed, and angular at the tip; tongue jagged, short, horny at the tip; the nostrils are small, co-

vered with bristles; the feet are formed for walking; the hind-toe is long. Gmelin reckons twelve

Species.

* **EUROPEÆ**; European Nuthatch. Cinereous, beneath reddish; the tail-feathers black; the four lateral ones beneath are tipped with white. It weighs nearly an ounce; its length is five inches; the bill is strong and straight, and about three-quarters of an inch long; the upper mandible is black, the lower white; the irides hazel; the crown of the head, back, and coverts of the wings, are of a fine bluish-grey; a black stroke passes over the eye from the mouth; the cheeks and chin are white; the breast and belly are of a dull orange-colour; the quill-feathers are dusky; the wings underneath are marked with two spots, one white, at the root of the exterior quills, the other black, at the joint of the bastard-wing; the tail consists of twelve feathers, the two middle are grey, the two exterior feathers tipped with grey, then succeeds a transverse spot, beneath that the rest is black; the legs are of a pale yellow; the back toe very strong, and the claws large. Such is Mr. Pennant's description of the European nuthatch, who adds, that "this bird runs up and down the bodies of trees like the woodpecker tribe, and feeds not only on insects but on nuts, of which it lays up a considerable quantity, as winter provision, in the hollows of trees. It breeds likewise in the hollows of trees; and if the entrance be too large, it stops up part of it with clay, leaving only room enough for admission. In autumn it begins a chattering noise, being silent the greater part of the year. This bird makes its nest of dead leaves, mostly of the oak, which it heaps together without much order. It lays six or seven eggs, which are white, spotted with rust colour, so exactly like those of the great titmouse, that it is almost impossible to distinguish them. No persecution will force this little bird from its habitation, when sitting: it defends its nest to the last extremity, strikes the invader with its bill and wings, and makes a hissing noise; and after every effort of defence, will suffer itself to be taken in hand, rather than quit its post."

"The nuthatch," says colonel Montague, in his Ornithological Dictionary, "is more expert in climbing than the woodpecker; for it runs in all directions up and down a tree, whereas the other is never observed to descend: the stiff tail of those birds support them in the act of climbing and hacking. The flexible tail of the nuthatch gives it no such advantage, nor does it seem to want it; for its most favourite position, when breaking a nut, is with the head downwards. In autumn it is no uncommon thing to find, in the crevices of the bark of an old tree, a great many broken nut-shells, the work of this bird, who repeatedly returns to the same spot for this purpose. When it has fixed the nut firmly in a chink, it turns on all sides, in order to strike it with the most advantage. This, with the common hazel-nut, is a work of some labour; but it breaks the filberd with ease. In defect of such food, insects and their larvæ are sought after among the moss on trees, and old thatched buildings. It is commonly met with about orchards, and is sometimes seen, in the eider season, picking the seeds from the refuse of the pressed apples. The note is various: in the spring it has a remarkably loud shrill whistle, which ceases after incubation; in autumn is a double reiterated cry." There is a variety, called the little nuthatch, which is much smaller than the common nuthatch, and of a more noisy disposition. It resides in similar situations, and is equally solitary; associating only with its mate, and attacking any other it may happen to see.

CANADENSIS;

CANADENSIS; Canada Nuthatch. Cinereous, beneath pale rufous; eye-lids white. This is of the size of the European species; the bill is blackish; crown of the head, hind part of the neck, and shoulders, black; the back and rump are of a light grey; over each eye is a white line; the cheeks are white; larger quill-feathers dusky, with grey edges; breast and belly pure white; the two middle tail-feathers are grey, the rest black, with a white spot at the tip; the vent is ferruginous, and the legs are brown. It is, as its specific name imports, a native of Canada, and extends its journeys as far south as New York. Mr. Pennant makes it a mere variety of the European nuthatch; but by Linnæus and Latham it is regarded as a distinct species.

CAROLINENSIS; Black-headed Nuthatch. Cinereous, beneath whitish; lower part of the belly reddish; head and neck above black; lateral tail-feathers white, varied with black. It is a native of the temperate parts of America, and of the island of Jamaica.

JAMAICENSIS; Jamaica Nuthatch. Cinereous, beneath white; crown black; lateral tail-feathers blackish, tipped with transverse white lines. This has been described by Sir Hans Sloane in his Natural History of Jamaica. It is of the size of the common nuthatch, the length being five inches and a half; the bill nearly an inch long, and black; the head is large, with a black crown. It is, as its specific name imports, a native of the island of Jamaica. It is also found in many parts of South America, feeding on insects, and having the character of a stupid bird, easily suffering itself to be taken. From the size of its head, it is known in Jamaica by the name of loggerhead. There is a variety much less.

PUSILA; Small Nuthatch. Cinereous, beneath dirty white; the head is brown, with a dirty white spot behind; the lateral tail-feathers are black. It inhabits North America, and is said to be found in Carolina throughout the whole year.

MAJOR; Great Nuthatch. Grey, beneath whitish; the chin is white; the quill and tail-feathers brown, edged with orange. This is described by Sir Hans Sloane in the History of Jamaica; it is seven inches and a half long; the bill is thickest in the middle, and curved at the end; the head and back are grey; the under parts are whitish; the wings and tail are brown, with orange edges. It is a native of Jamaica, and feeds on worms, insects, &c.

NÆVIA; Spotted Nuthatch. Above it is of a lead-colour, beneath glaucous; the chin is white; the wing-coverts are spotted with white. This bird is described by Edwards under the title of wall-creeper of Surinam, who says, the bill is long in proportion, straight, somewhat compressed sideways, a little hooked at the point, and of a dusky brownish colour; the head, the hinder side of the neck, back, rump, tail, and wings, are of a dark blueish-lead colour; all the covert-feathers on the upper side of the wings are tipped with white; the insides of the quills and under side of the tail-feathers are ash-coloured, lighter than they are above; the throat is white; the breast, belly, thighs, and coverts beneath the tail, are of a blueish-ash colour, lighter than the upper side of the bird; from the throat, as far as the legs, the breast is marked with white lines, drawn down the middle of each feather, which end in points; the legs and feet are of a dusky brown colour. The length of this bird is about six inches. It is, as its trivial name imports, a native of Surinam.

SURINAMENSIS; Surinam Nuthatch. Reddish-chestnut, beneath it is of a dirty white; middle of the back white; wings and tail black; wing and tail-coverts tipped, and

secondary quill-feathers edged, with white. This is a very small species, not much more than three inches in length; the bill is of a dusky brown, and a little curved; the hind-head and neck are marked with oblong black spots. It is, as its specific name imports, a native of Surinam.

CAFFRA; Cape Nuthatch. Body beneath is yellow, above yellow, varied with black; the legs are black. It inhabits the Cape of Good Hope. This was described by Sparmann, and is by him said to be nine inches in length, with a straight blueish-black bill; the front, hind part of the neck, and back, mixed with brown and yellow; cheeks, neck, breast, and under parts, are of a dusky yellow, as are also the edges and tips of the wing-feathers; the tail is dusky black, beneath olive; the two middle feathers longer than the rest; the legs are black.

SINENSIS; Chinese Nuthatch. The specific character of this, according to Gmelin, is, that the lower eye-lid is purple. But Dr. Shaw denominates it the ferruginous nuthatch, with black head and neck, white breast and abdomen, a red spot behind the eye, and another white one. This bird is described by Latham as something larger than the goldfinch; the bill and head are black; the back is of a deep blueish-ferruginous; the throat, breast, and belly, are white, but the throat is encompassed by a black band, descending from the sides of the head, which is black and crested; near the eye is a small scarlet spot, succeeded by a large white one; the rump is yellow; the tail blackish, with a white tip; the bill and legs are black. It is, as its name denotes, a native of China, where it is said to be much esteemed on account of the elegance of its colours, and is a frequent ornament on Chinese papers. "It appears," says Dr. Shaw, "to be much allied to the *Lanius jocosus*, or red-vented shrike, and may perhaps prove, on future investigation, to be no other than the same bird."

LONGIROSTRA; Long-billed Nuthatch. Blueish, beneath pale rufous; primary quill-feathers tipped with brown; the lores are black. This species is described by Dr. Latham, and is said to measure nine inches; the bill is above an inch long, and black, but the base is pale or whitish; the crown of the head and whole upper parts of the bird are of a pale blueish-grey, but the cheeks and forehead are white, and a black streak passes through each eye, along the sides of the neck; the wings are tipped with brown, and the under parts of the bird are pale tawny; the legs are of a pale brown. It inhabits Batavia.

CHLONIS; Green Nuthatch. Above green, beneath white; the tail is black, tipped with yellowish; the bill is longer than the head, and blackish towards the tip; quill-feathers brown, outer edge greenish, yellowish in the middle, forming a yellowish band on the wings; the rump is yellowish, and the tail short. It is a native of the Cape of Good Hope, and is of the size of the Surinam nuthatch.

SITTACENE, in *Ancient Geography*, a country of Asia, in Assyria, near Susiana. Ptolemy.

SITTACENI, the name of those people of Asiatic Sarmatia, who inhabited the vicinity of the Palus Mæotis.

SITTART, in *Geography*, a town of France, in the department of the Roer; 12 miles S. of Ruremond.

SITTEBERIS, in *Ancient Geography*, a town of India, on this side of the Ganges. Ptolemy.

SITTENBACH, ALT, in *Geography*, a town of Bavaria, in the territory of Nuremberg; 3 miles W. of Herfbruck.

SITTENBACH, Kirch, a town of Bavaria, in the territory of Nuremberg; 5 miles N. of Herfbruck.

SITTENSEN,

SITTENSEN, a town of Germany, in the duchy of Verden; 18 miles N.E. of Rottenburg.

SITTER, a river of Switzerland, which rises in the canton of Appenzell, and joins the Thur, 9 miles W. of St. Gal.

SITTICHENBACH, a town of Saxony; 6 miles N.W. of Querfurt.

SITTICOTE, a town of Hindoostan, in Dowlatabad; 30 miles S. of Renapur.

SITTINGBOURNE, a post and fair-town in a parish of the same name, hundred of Milton, and county of Kent, England, is situated on the high road from London to Canterbury, at the distance of 40 miles S.E. from the metropolis, and 13 miles N.E. by E. from Maidstone. This place is of considerable antiquity, and derives its name, by corruption, from the Saxon word "Sædingburna," which signifies the village by the bourne or stream. Henry V. was entertained here, on his triumphant return from France, by John Northwood, esq. of Northwood, in a style of magnificence befitting the royal dignity. Queen Elizabeth incorporated this town by charter, and conferred upon it the privileges of a weekly market and fairs, first in the 16th year of her reign, and again in her 41st year. By the latter deed, the corporation was constituted by the style of the mayor and jurats, and was invested with the right of sending two members to parliament. These privileges, however, never seem to have been exercised; and even the market was dropped in a few years; but the fairs are still kept on Whitmonday and the two following days, and on the 10th of October and the four following days.

Sittingbourne chiefly forms one wide street on the high road, which here descends towards the east. The principal support of its inhabitants arises from the custom of travellers who pass through it. The inns are numerous, and some of them equal in magnificence to any provincial inn in the kingdom. The church is a spacious structure, divided into a nave and two aisles, a chancel, two chapels, and a tower, which rises at the west end. The whole has been rebuilt, with the exception of the tower, since the year 1762, when it was destroyed by fire. By that catastrophe, most of the monuments perished; and such of them as were preserved, were so capriciously removed, that few of them cover the remains of the persons they were intended to commemorate. The most curious monument remaining is one in the north, or Bayford chapel, which consists of a table-slab of Bethersden marble, placed under an obtusely pointed arch, ornamented with quatrefoil compartments, displaying heads, shields, fleur-de-lis, &c. and having, in the recess behind it, the emaciated figure of a female in a winding-sheet.

Sittingbourne parish is of small extent, and contains, according to the parliamentary returns of 1811, 239 houses, and 1362 inhabitants. Lewis Theobald, who published two editions of Shakspeare's plays, with notes, in 1733 and 1740, was a native of this parish.

At Bayford, to the north of Sittingbourne, are some remains of an ancient intrenchment, said to have been formed by king Alfred, when he came hither to repel the incursions of the Danes, in the year 893. This place was afterwards the site of a castle, which, in the time of Edward I., was the baronial seat of Robert de Nottingham, as appears from various deeds still extant, bearing date "Apud castellum suum de Bayford apud Goodneston." Hausted's History of Kent, vol. vi. Svo. edit. 1798. Beauties of England and Wales, vol. vii. by E. W. Brayley, 1806.

SITTUKERA, a town of Hindoostan, in the soubah of Moultan; 15 miles from Shawanaz.

SITUA, in *Ancient Geography*, a town of Asia, in Paphlagonia.

SITUS, in *Geometry* and *Algebra*, denotes the situation of lines, surfaces, &c.

Wolfius gives us some things in geometry, which are not deduced from the common analysis; particularly, matters depending on the situs of lines and figures. M. Leibnitz has even invented a particular kind of analysis thereon, called *calculus situs*.

SITZENBERG, in *Geography*, a town of Austria; 10 miles W.S.W. of Tulin.

SITZKOI, a town of Russia, in the government of Olonetz; 12 miles E.S.E. of Ladeinoepole.

SIVA, in *Ancient Geography*, a town of Cappadocia, in the prefecture of Cilicia. Ptolemy.

SIVA, in *Hindoo Mythology*, is a personification of one of the three great powers of the deity. Siva is usually deemed the third person in the Hindoo triad, and to represent the *destructive* energy. A detailed account of this important personage would extend itself to a history of the whole Hindoo Pantheon; for he appears in such a variety of forms, and on so many occasions, that scarcely a step can be taken in any department whatever of eastern science, art, or subject of literature, without encountering Siva in some of his varied characters. Under the articles SAIVA and VAISHNAVA we have stated, that the whole race of Hindoos are divided into those two classes, denoting the worship of Siva, or of Vishnu; Brahma, the first or creative power, having no worshippers, or temples. Of this curious fact, see under SARASWATI, the name of his consort. These two comprehensive classes are also called Saiva-bakht, and Vishnu-bakht. See *SECTS of Hindoos*.

As the *destructive* energy of the deity, Siva is most usually seen; but destruction being used in the sense of renovation, the character of Siva is that of the renovator, or recreator; associating him in character with Brahma, the producing or creative power. See *VEDANTA*.

We will try to exhibit, at one view, the variety of relations in which this and the other two members of the Hindoo triad appear; whether they be introduced mythologically, metaphysically, or philosophically. All three are symbols of the sun, as he is typical of that great light, as the theologians express it, "whence all proceeded, and to which all must return." See *O'M*.

Brahma	Power	Creation	Matter	The past	Earth.
Vishnu	Wisdom	Preservation	Space	The present	Water.
Siva	Justice	Destruction	Time	The future	Fire.

But these characters, or attributes, are not exclusively applicable to the three powers, as indicated above. They coalesce and participate, more or less, in several. An attempt has been made to shew in what degree, more particularly, they represent their material forms of earth, water, and fire: thus,

Brahma and Siva are Fire, in which Vishnu	} does not participate, or participates but remotely.
Vishnu and Brahma are Earth, in which Siva	
Siva and Vishnu are Water, in which Brahma	

As well as affinities, these powers have opposing properties; contests of persons, in mythological language, and in that of the mystics, attractions, and love.

The contests of these powers, or persons, their quarrels and reconciliations, yield fine occasions for poetical exuberance. The preservative and regenerative powers, being in constant action, are feigned to have defended on earth innumerable times, in divers places, for the instruction and benefit, including the salutary punishment, of mankind.

The wives and children of these powers have also, like their lords and parents, descended and assumed a variety of forms on earth, for similar purposes. The history of these endless incarnations affords ample scope for the imagination; and they are worked up by the poets, with wonderful fertility of genius and pomp of language, into a variety of sublime descriptions, interspersed with theological and moral texts, that at length were received as inspired productions, and have become the standard of divine truth. See PURANA, the title of a series of mythological poems, or rather of poems on every subject, under the similitude of mythological adventure.

The wives or consorts of these mythological personages are mentioned above. All the Hindoo deities are mated in fable, and their spouses are their powers or active energies, and are called their *Sakti*. See that article.

The Hindoo deities have also vehicles assigned for the conveyance of themselves and wives. These are called *vahan*. The *vahan* of Siva is a bull, called Nandi. They have likewise peculiar symbols or attributes: those that more particularly designate Siva, his *fakti*, or any thing connected with them, are the Linga, or phallus, and the Trifula, or trident. The phallic emblem denotes his presiding over generation; reminding us of the Jupiter Genitor of western mythologists, with whom sir William Jones identifies the Siva of the East.

There is yet another attribute of Mahadeva, (a name of Siva,) by which he is too visibly distinguished in the drawings and temples of Bengal. To *destroy*, according to the Vedantists of India, the Sufis of Persia, and many philosophers of our European schools, is only to *generate and reproduce* in another form. Hence the god of *destruction* presides over *generation*; as a symbol of which he rides on a *white bull*. Can we doubt that the loves and feasts of Jupiter Genitor, (not forgetting the white bull of Europa,) and his extraordinary title of *Lapis*, for which no satisfactory reason is commonly given, have a connection with the Indian philosophy and mythology?

The Jupiter Marinus, or Neptune of the Romans, resembles Mahadeva in his generative character; especially as the Hindoo god is the husband of Parvati, whose relation to the *waters* is evidently marked, by her image being restored to them at the conclusion of the great festival called Durgotava. She is known to have attributes exactly similar to those of Venus Marina, whose birth from the sea-foam, and splendid rise from the couch in which she had been cradled, have offered so many charming subjects for ancient and modern poetry. Diss. on the Gods of Greece, Italy, and India. Asiat. Ref. vol. i.

Another writer, Mr. Paterfon, in the eighth volume of the same work, offers a passage descriptive of the character and attributes of Siva. "To Siva," he says, "are given three eyes, probably to denote his view of the three divisions of time; the past, the present, and the future. A crescent on his forehead, portrays the measure of time by the phases of the moon; a serpent forms a necklace to denote the measure of time by years; a second necklace, formed of human skulls, marks the lapse and revolutions of ages, and the extinction and succession of the generations of mankind. He holds a trident, to shew that the great attributes are in him allembled and united; in another is a kind of rattle, shaped like an hour-glass, and I am inclined to think that it was at first intended as such, since it agrees with the character of the deity; and a sand *gheri* is mentioned in the Sastra as a mode of measuring time. In the hieroglyphic of Maha Pralaya, or grand consummation of all things, when time itself shall be no more,

he is represented as trodden under foot by Mahakala, or eternity." In this character he is called Kalanteka.

An anonymous writer (Edinburgh Review, N^o XXXIV. p. 316.) has offered some points of comparison between the Osiris of Egypt, the Bacchus of Greece, and the Siva of India, that will serve to illustrate our observations on the latter. "Osiris was adored in Egypt, and Bacchus in Greece, under the emblem of the phallus. It is under the same emblem that he is still venerated in Hindoostan, and Phallus is one of his names in the dictionary of Amara Singha. The bull was sacred to him in Egypt. Plutarch assures us that several nations of Greece depict Bacchus with a bull's head; and that when he is invoked by the women of Elis, they pray him to hasten to their relief on the feet of a bull. In India he is often seen mounted on a bull; hence one of his Sanscrit names, Vrishadwaja, signifying, whose ensign is a bull. Plutarch informs us, that 'Nilum patrem ac servatorem suæ regionis, ac defluxum Osiridis nominant.' The Ganges, in like manner, is fabled by the Hindoos to flow from the tresses of Siva; hence another of his names, Gangadhara, the supporter of the Ganges. We conceive, by the way, that Scaliger and Selden are mistaken in supposing that Siris, the Egyptian name of the Nile, is synonymous with Osiris. Siris seems to us the Sanscrit word Saras, a river in general, or *the river*, from its imputed superiority. Isis is the consort of Osiris; Isa that of Iswara, or Siva. (See ISA.) The attributes of the goddesses might be shewn to correspond as precisely as those of their lords. The attendants of Iswara resemble in their frantic demeanour the furious Bacchantes of the god of Naxos. It is remarkable, that many of the appellations by which the Greeks distinguish Bacchus, are also used by the Hindoos; but instead of applying them to Baghesa himself, the latter give them to his son, whilst both nations have their legends to account for them. Thus, the Greeks named Bacchus, Dimeter, having two mothers; the Hindoos call Skanda, the son of Baghesa, Divimatri, with the same signification. (See SKANDA.) Pyrgines, born from fire, and its equivalent in Sanscrit, Agniya, are respectively Greek and Indian appellatives of Bacchus and Skanda. The title of Thriambus, we are told by Diodorus, was assumed by the Greek deity, in his triumph after the conquest of India. Tryambo, in like manner, is one of the most common appellations of the Indian Bacchus, but we are not aware of its signification." See TRIAMBO.

We will subjoin what is given in the same article, as descriptive of Siva, under his name of Iswara, taken from a copious treatise in the Imperial library at Paris, entitled Hyasiras, but the MS. did not specify from what Purana it was extracted. The Matsya Purana exhibits a full code of similar instructions for the guidance of artists in portraying the various deities of the Hindoo Pantheon. (See PURANA.) We premise that the name Iswara means *powerful*; a character denoted by many hands, in the way that many heads denote sapience.

Iswara.—Let the arms, shoulders, and thighs of Iswara be brawny and muscular; his colour that of the beams of the crescent which decorates his brow; his long hair must be knotted in many convolutions; his shoulders covered by a tiger's skin; his ten arms ornamented with bracelets of snakes; pendants hang from his ears: a sword, a club, a trident, and other weapons, are perceived in his hands. When he appears in the character of the vanquisher of Tripura, during the conflagration of the city, he has sixteen arms. (See TRIPURA.) In the character of Yogeswara, his aspect must be terrific. See YOGESWARA.

Images and pictures of Siva, which, in his various characters,

ters, are very common, represent him under a great many forms, which our limits will not allow us to enumerate.

In some pictures he is seen four, six, eight, or ten, and as far as sixteen-handed; and in one character with five faces, thence called *Panchamuki*, which see; in sitting, standing, and dancing attitudes. His attributes are nearly similar to those of his fakti Parvati. Representations of him, or of his family or sect, are distinguished by the Linga, or cone, the Trifida, or trident, the Pasha, or cord of punishment, (see *PASHA*); the third eye, and collar of skulls, peculiar to him, his consort, or family; the moon and Ganga in his hair; a hand drum, shaped like an hour-glass, and called, both in Sanscrit and Greek, *dindima*, and hence probably the name of Dindimia, and other similar names given to the Grecian *queen of heaven*; and Dindymos, a fabulous mountain consecrated by the Argonauts to the *mother of the gods*; titles as well of the consort of the Indian Siva as of the Grecian Jupiter. An antelope, named Sasin, is sometimes seen in Siva's hand, supposed to have some lunar allusion. (See *SASIN*.) These are his most common attributes. Sometimes he is joined to his fakti, denoting then a mystical reunion of the powers of nature.

The fable of Bramah losing one of his heads has not hitherto been explained. It may probably mean that Bramah, or matter, undergoes curtailment by the destructive energy of fire, or Siva. Bramah had once five heads; he has now only four. Perhaps the older cosmogonies may have assigned five elements to the compeponcy of matter, which a subsequent theory, promulgated by a Saiva, reduced to four. From such speculations originate the fables of mythology. Saying that Siva is Brahma, may mean, that as renovator of forms, he is the recreator; matter being by some theories eternal; and creation, as we term it, being merely a periodical reorganization. (See *KALPA*.) He is the parent and the offspring of Vishnu. This is said according with the theory or sect, or the philosophy or religion, of the relator. (See *SECTS of Hindoos*.) Philosophically, it may mean that fire, or heat, is the *source* of water by its evaporating power, and the *effect* of humidity, through the process of fermentation; either terrestrial, or by aerial combination. Vishnu, it will be recollected, is a personification of humidity, and we may thus discern why Siva and Vishnu may be mythologically parent and offspring. In the article *SRADHA* an invocation to fire is given, from the funeral ceremonies of the Hindoos, denoting its renovating property. "Fire! thou was lighted by him; may he therefore be reproduced by thee."

As the patron of astronomy, Siva is the Uranus of the East. He is said to guide the motions of the planet Jupiter, named by the Hindoos *VRIHASPATI*; see that article. He has been already noticed as the sun, though that luminary, or its regent Surya, is more strikingly assignable to a relationship with Vishnu.

As destructive fire, that powerful changer of forms, Siva is, in a philosophical view, more immediately considered. Of him in this character, the cone or linga, it is said, is his symbol; being the form naturally assumed by flame; and the inverted cone, as the figure of water naturally descending, is symbolical of Vishnu. A triangle, with its apex upward or downward, is therefore, being conical, the symbol of these important deities, in their primary characters of fire and water. Sometimes these are seen combined, and are then mystically contemplated as the re-union of nature's elements.

The sectaries of these powers, the conservative and the changing, respectively uphold the supremacy of that worshipped severally by each. Siva being more immediately

fire, and Vishnu water, the philosophical contests for supremacy, which have, it is related, been carried to the sad length of theological war, on the parts of the adherents of these different doctrines, may remind one of those controversies, happily extending no farther, carried on in Europe by the parties at length denominated Vulcanists and Neptunists. The difference is, that in Europe the causes of the world's destruction by the deluge, and in India, the mode of its reformation at the period called kalpa, after a pralaya, or disorganization, is the point in dispute between their respective Saivas and Vaishnavas; or, in other words, the Vulcanists and Neptunists. Another instance, consonant to an European distinction, may be here noticed. It is said that individuals of the sect of Saiva are of a more reserved or serious cast than those of the Vaishnava sect. Gloomy individuals are more disposed to the reverent contemplation of the destructive and avenging attributes of the god of justice; or in other words, is it that those who adopt such adoration are thence gloomy and dark? Those, on the other hand, who contemplate and adore the deity in his attributes of preservation and mercy, are of a more cheerful turn. Thus the Saivas are the Calvinists, the Vaishnavas or Baudhas the Lutherans of India.

Siva, as the consort of Kali, is named Kal or Kala, supposed to be time; for *kal*, in Sanscrit and other languages of India, means both yesterday and to-morrow: it means also *black*; and in this character Siva, as well as his fakti, is painted of that colour, though under other forms, and usually, white is the colour of Siva. The contemplation of the distinctions of day and night; of the light and dark divisions of the month, a notation of time especially and superstitiously attended to in Hindoo ceremonials; of the six months' day and six months' night of the gods (occasioned by the obliquity of the sun's path); and, lastly, the contrast of the visible creation with eternal night; are supposed by a writer in the Asiatic Researches (Mr. Paterfon,) to have suggested the idea of painting Kal white and Kali black. When, however, he appears as Kal, he is sometimes, as above noticed, also black.

To Siva, in his various forms, several plants are esteemed sacred, and are of course nourished by his sectaries; chiefly, it may be presumed, by women, by the aged, or by Brahmans. A shrub named *Afoka*, is one supposed to be pleasing to Siva. It is described in the fourth volume of the Asiatic Researches, art. 17, by sir W. Jones, who says, that the vegetable world scarcely exhibits a richer sight than an *afoka* tree in full bloom: it is about as high as an ordinary cherry-tree. He expresses a hope that its Sanscrit name may be retained by botanists, as it perpetually occurs in the old Indian poems, and in treatises on religious rites. It is planted near Siva's temples, and his worshippers look for efficacy from bathing on a particular day in some holy stream, and drinking water with buds of the *afoka* floating in it. The name means *grief*, or lamentation, and is derived by mythologists from the grief of Sita, when confined in a grove of it on Ceylon, by the tyrant Ravana. *Sami* is the name of another shrub sacred to Siva, connected with which a great deal of enthusiastic extravagance might be pointed out. It may be remarked, that in their selection of holy vegetables, the Brahmans have shewed considerable taste by sanctifying those of the most lovely sorts.

One of the Sanscrit appellations of Siva is the god with a thousand names. These are given at length in the Padma Purana; and the sixty-ninth chapter of the Siva Purana is allotted to their enumeration. We proposed making a selection of some of them in this article; but it has already been enlarged to its utmost allowable extent.

For a further account of Siva and his family, we refer to several articles that have occurred in this work, and particularly to KAMA, LOTOS, MATRI, PATRA, PHILOSOPHY of the Hindoos, SECTS of Hindoos, SAGNIKA, SANKYA, and VEDANTA.

To this article reference is made from Parvati, of which indeed this may be considered as a continuation, and several errors of the press occurring in the latter, we take this opportunity of pointing them out correctively.—In col. 3, line 6, for *cap*, read *cup*; col. 4, l. 35, for *beauty's*, read *brevity's*; col. 5, l. 2, for *Karlikya*, read *Kartikya*; col. 5, l. 9 from the bottom, for *central is*, read *central eye is*.

SIVAN, in *Chronology*, the third month of the Jewish ecclesiastical year, answering to part of our May and June.

SIVAS, in *Geography*, a very large and populous town of Asiatic Turkey, and capital of a government, to which it gives name, the residence of a pacha; anciently called "Schalle." It is very well watered by the river: Cassal-mack, and several fountains and many clear streams, which run through it. It is seated on the W. side of a very fertile valley, which is almost surrounded by lofty mountains, having no opening except where the river runs in and out, through a very narrow channel between two steep hills. Here are two stone bridges at the distance of about a mile from each other. Corn in great abundance grows in this valley, but here is not much fruit, excepting plums, apples, and pears; but of garden vegetables there is plenty. In the middle of the town are some very extensive gardens; and on an artificial hill is an old castle, now tumbling into ruins. The houses in general have a very ordinary appearance, though the neighbourhood furnishes plenty of good materials for building; a great quantity of unsquared timber being employed to support an immense weight of stone and clay, with which the houses are covered. The inhabitants appear to enjoy much liberty; nor are the women confined, as in some large cities to the eastward. According to Mr. Jackson's account in his "Journey from India," Sivas is nearly as large as Liverpool, contains as many houses, and is fully as populous. Although most of the private houses are indifferent structures, many of the public buildings are elegant, and some of the monuments very lofty. In the year 1394 this city was taken by Bajazet, and soon after by Tamerlane, who destroyed the town and made a terrible slaughter of the inhabitants. N. lat. 38° 15'. E. long. 37°.

SIVATA, in *Ancient Geography*, a town of Asia, in Galatia. Ptolemy.

SIVEH, in *Geography*, a town of Persia, in the province of Mekran, on the Nehenk; 110 miles N.N.E. of Kidge.

SIUEN-TCHEOU, a city of China, of the first rank, in Fo-kien. N. lat. 24° 55'. E. long. 118° 29'.

SIVERIE. See SEVERIA.

SIVERS, HENRY JACOB, in *Biography*, was born at Lubec in 1709. At the age of 17 he took his degree, as master of arts, at Rosstock, and having become soon after a teacher in that seat of learning, he published, in 1730, a thesis, "De Fide Salvifica," by which he became advantageously known to the literary world. It was, in fact, an answer to a book written by Dr. Eric Pontoppidan, entitled "The Bright Mirror of Faith, in which are displayed the Marks of the Children of God." Soon after he stood candidate for the ministry at Lubec; and, on being licensed, he acquired so much popularity, that the churches were crowded wherever he preached. In 1734 he made a tour to Denmark and Sweden, to collect objects for a museum of natural history which he began to form, and settling in the latter, he was invited to be one of the pastors of the

German congregation at Norkoeeping; after this he was ordained by bishop Berzelius, and in 1746 was made one of the court chaplains. In 1747 he obtained the office of pastor of Trynerym from count Horn, and in the following year he died, in the 50th year of his age. He was a man of considerable learning, and possessed a very fine library. He had likewise accumulated a numerous collection of antiquities, natural productions, and various curiosities of art; but in 1737 he had been obliged to sell to count Charles Gyllenberg the half of his minerals, and a fine cabinet of Roman coins, which the count afterwards bequeathed to the academy of Lund. He carried on an extensive correspondence with the celebrated Linnæus, and in 1731 was elected a member of the Academy of Sciences at Berlin. He left behind him a large number of MSS., and he is said to have published more than a hundred different pieces, the titles of many of which are given in the Gen. Biog.

SIVIDURG, in *Geography*, a town of Hindooitan, in Myfore; 10 miles E. of Anantpour.

SIUM, in *Botany*, an old Latin name, *σιου* of Dioscorides, of whose etymology nothing plausible has occurred to us, except the opinion of De Theis, who deduces the word from the Celtic *siw*, water:—the plant thus called by Dioscorides, and every other writer, being an aquatic, of a small stature, succulent, and aromatic, with parsley-like leaves, as described in his work. Such is the *Sium* of modern botanists, as to most of its species; but their medicinal qualities do not well answer to the report of this old writer, the root especially being esteemed highly dangerous, like the generality of umbelliferous plants, that grow in water; nor should we trust to the herbage, either "recent or boiled, to break down and expel *calculi*, to promote urine or child-birth, or to cure the dysentery."—Linn. Gen. 138. Schreb. 188. Willd. Sp. Pl. v. 1. 1431. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 312. Prodr. Fl. Græc. Sibth. v. 1. 194. Ait. Hort. Kew. v. 2. 144. Pursh 194. Juss. 222. Lamarck Illustr. t. 197. Gærtn. t. 23.—Class and order, *Pentandria Digynia*. Nat. Ord. *Umbellata*, Linn. *Umbellifera*, Juss.

Gen. Ch. *General Umbel* various in different species; *partial* spreading, flat. *General Involucrum* reflexed, of numerous lanceolate leaves, shorter than the umbel; *partial* of many small linear leaves. *Perianth* scarcely discernible. *Cor.* *Universal* uniform; flowers all fertile; *partial* of five equal petals, rendered heart-shaped by their inflexed points. *Stam.* Filaments five, simple; anthers simple. *Pist.* Germen minute, inferior; styles two, reflexed; stigmas obtuse. *Peric.* Fruit roundish-ovate, compressed, small, striated, separable into two parts. *Seeds* two, nearly ovate, convex and striated on the outer side, flat on the other.

Eff. Ch. Fruit nearly ovate, compressed, striated. *General* and *partial involucrum* of many leaves. Petals heart-shaped, uniform.

1. *S. filifolium*. Thread-leaved Water-parsnep. Thunb. Prodr. 50. Willd. n. 1. ("Conium tenuifolium; Vahl Symb. v. 3. 49.")—"Radical and stem-leaves simple, thread-shaped. Involucrum elongated."—Native of the Cape of Good Hope. We know nothing further about this species.

2. *S. latifolium*. Broad-leaved Water-parsnep. Linn. Sp. Pl. 361. Willd. n. 2. Fl. Brit. n. 1. Engl. Bot. t. 204. Fl. Dan. t. 246. Jacq. Austr. t. 66. (Sium; Rivin. Pentap. Irr. t. 78. *S. majus latifolium*; Ger. Em. 256.)—Leaves pinnate; leaflets oblong-lanceolate, equally serrated.—Native of rivulets, ditches, and watery ground, in the north of Europe; rather common in England, flowering in July and August. *Root* perennial, of many long, thick, whorled fibres, from the lower joints of the stem, by which

which the plant in some degree creeps along the muddy bottoms of pools and ditches. *Stem* erect, angular, hollow, leafy, smooth, scarcely branched. *Leaves* alternate, of about three pair of oblong, sessile, smooth leaflets, besides a terminal, stalked, rather longer one; all acute, neatly serrated, varying in breadth; those under water are liable to be finely divided. *Umbels* large, flattish, white, erect, solitary, terminal and lateral. *Involucral leaves* widely spreading, lanceolate, white-edged, sometimes lobed, often serrated. *Calyx* of five small teeth. *Petals* sometimes slightly unequal in size, as is nearly universal in this tribe. The whole *herb* is acrid, and the *roots* especially are reckoned poisonous. This species does not appear to be a native of Greece, nor to have been known to Dioscorides.

3. *S. angustifolium*. Narrow-leaved Water-parsnep. Linn. Sp. Pl. 1672. Willd. n. 3. Fl. Brit. n. 2. Engl. Bot. t. 139. Prodr. Fl. Græc. n. 674. Jacq. Austr. t. 67. (*S. nodiflorum*; Fl. Dan. t. 247. *S. erectum*; Hudf. ed. 1. 103. *S. minus*; Rivin. Pentap. Irr. t. 79. *S. majus angustifolium*; Ger. Em. 256.)—Leaves pinnate; leaflets irregularly lobed and serrated. *Umbels* stalked, opposite to the leaves. *Stem* erect.—Native of rivulets and ditches in Germany, England, France, and the south of Europe. Dr. Sibthorp found it in Greece; and it is more common with us than the preceding, flowering about July or August. The perennial *root* creeps to a considerable extent. The *herb* is of a smaller more delicate habit than the last, and known by the more unequal incisions of its *leaves*, at least the upper ones. The *leaflets* of the radical foliage are somewhat heart-shaped, their edges regularly serrated, and the lower pair distant from the next. *Umbels* solitary, each on a lateral stalk, shorter than the opposite leaf. *Leaves* of the general *involucrum* drooping, often cut or pinnatifid, often entire. *Calyx* of five hardly visible teeth.

4. *S. nodiflorum*. Procumbent Water-parsnep. Linn. Sp. Pl. 361. Willd. n. 4. Fl. Brit. n. 3. Engl. Bot. t. 639. Prodr. Fl. Græc. n. 675. Woodv. Med. Bot. t. 182. (*S. aquaticum repens et procumbens, ad alas floridum*; Morif. sect. 9. t. 5. f. 3.)—Leaves pinnate; leaflets ovate, equally serrated. *Umbels* sessile, opposite to the leaves. *Stem* procumbent.—Frequent in ditches and rivulets, throughout Europe, from Sweden to Greece, flowering in summer. Dr. Sibthorp observing this species abundantly in all the waters of the last-mentioned country, concludes it, with great probability, to be the real *σιον* of Dioscorides, as answering well to his description, and being called *νεροσίλων*, or water-parsley, by the modern Greeks. The *root* is perennial and creeping. *Stems* procumbent or floating, branched, bearing a nearly sessile greenish-white *umbel*, opposite to each leaf. The *leaflets* are somewhat heart-shaped at the base, acute, neatly and equally serrated, from five to nine in each leaf; the terminal one occasionally confluent with the next. *General involucrum* of one leaf, and often wanting; *partial* of several ovate ones. *Calyx* scarcely perceptible. The qualities of this species are probably milder than the two former, inasmuch that three large spoonfuls, mixed with milk, have been given twice a day, to cure cutaneous disorders; and this answers to the account given by Dioscorides, better than any thing we know of the rest of the genus.

5. *S. repens*. Creeping Water-parsnep. Linn. Suppl. 181. Willd. n. 5. Fl. Brit. n. 4. Engl. Bot. t. 1431. Jacq. Austr. t. 260.—Leaves pinnate; leaflets roundish, with deep tooth-like segments. *Umbels* stalked, opposite to the leaves. *Stem* creeping.—Native of moist pastures, and watery turfy bogs, in Bohemia, Austria, Scotland, and England, flowering from June to August. This is a much

smaller plant than the last, growing on wet ground, but not floating in water. The *stems* are quite prostrate, throwing out many radicles. *Leaflets* fewer, with broad notches, not fine serratures. *Umbels* more stalked, and whiter. *General involucrum*, as well as the *partial*, of several ribbed leaves. *Calyx* obsolete.

6. *S. Sifarum*. Skirret. Linn. Sp. Pl. 361. Willd. n. 6. Ait. n. 5. (*Sifarum*; Ger. Em. 1026. *Sifer primum*; Matth. Valgr. v. 1. 402. *Sju sjin, vulgò Nisji, &c.*; Kæmpf. Am. Exot. 818. t. 819. See Dryandr. in Tr. of Linn. Soc. v. 2. 228.)—Lower leaves pinnate; upper ternate; all sharply serrated. *Umbels* terminal.—Native of China. Cultivated, time out of mind, in Europe, for the sake of its perennial, fleshy, oblong, esculent roots, formerly reputed to possess an exciting quality. This notion perhaps originated with the Chinese; and that knavish nation seems, as Mr. Dryander first remarked, to have imposed upon the Japanese with these roots, for the true Ginseng of Tartary, or *Panax quinquefolia* of Linnæus, which latter seems to be *S. Nisji* of Thunberg. One may be as efficacious as the other, nor would a practitioner, of any description, now perhaps confide in either. The *herb* of the Skirret is twelve or eighteen inches high, erect, branched, leafy. Lower leaves of five or seven leaflets; upper of three; all copiously, neatly, and sharply serrated; the lowermost serratures often much the largest, or deepest, and somewhat spreading. *Umbels* at the tops of the branches, white, rather small, with few or no leaves in the general *involucrum*, but several linear or setaceous ones in the *partial*.—*Sium Nisji*, Linn. Sp. Pl. 361, having been entirely adopted from Kæmpfer's figure of the present, that species falls to the ground; nor is it entitled to rank even as a variety, though marked as such by Willdenow.

7. *S. rigidius*. Virginian Water-parsnep. Linn. Sp. Pl. 362. Willd. n. 7. Ait. n. 6. Pursh n. 1. (*Oenanthe maxima virginiana, pæoniæ fœminæ foliis*; Morif. sect. 9. t. 7. f. 1.)—Leaves pinnate; leaflets lanceolate, very nearly entire.—In wet meadows, from Pennsylvania to Virginia, flowering in July and August. *Flowers* small. This and the following, *S. lineare*, are considered as very poisonous plants, especially to horned cattle, and every farmer who knows their bad qualities is busily employed to destroy them." *Pursh*. The *roots*, and general habit, of this species bear considerable resemblance to the last; but the *leaflets* are more numerous, narrower, tapering at each end, and either quite entire, or with two or three broad notches only, here and there, in the lower *leaves*. The *umbels* are thrice the size of *S. Sifarum*, but, like them, are accompanied by only a slight general *involucrum*, nor are the *partial* ones much more considerable.

8. *S. lineare*. Linear Water-parsnep. Michaux Boreal-Amer. v. 1. 167. Pursh n. 2. (*S. suave*; Walter Carol. 115.)—"Leaves pinnate, leaflets elongated, linear, or slightly lanceolate, rather distantly serrated. *General involucrum* of few leaves; *partial* of many linear ones. *Umbel* with short rays."—In wet meadows, and by the sides of ditches, from Canada to Pennsylvania, flowering in July; perennial. *Pursh*.

9. *S. longifolium*. Long-leaved Water-parsnep. Pursh n. 3.—"Leaves pinnate; leaflets of the lower ones very long, linear, falcate, sparingly toothed. *Stem* slightly leafy; naked above. *Umbels* usually in pairs, with scarcely any *involucrum*."—In the ditches and bogs of New Jersey, flowering in August.—Very slender, perennial. *Pursh*.

10. *S. japonicum*. Japanese Water-parsnep. Thunb. Jap. 118. Willd. n. 8.—Leaves pinnate; leaflets of the lower ones oblong or ovate, variously cut; of the upper lanceolate,

lanccolate, entire. Umbels terminal.—Native of Japan, flowering in June. The inhabitants call it *Saiko*, or *Mits Suba Seri*. The stem is erect, zig-zag, branched at the upper part. Leaves smooth, the lower ones very large, with spreading variously shaped leaflets, which are either ovate or oblong, undivided or cut; the upper leaves minute. Umbels terminating the branches. Thunb.

11. *S. Falcaria*. Decurrent Water-parfneq. Linn. Sp. Pl. 362. Willd. n. 9. Ait. n. 7. Prodr. Fl. Græc. n. 676. Jacq. Austr. t. 257. (S. n. 782; Hall. Hist. v. 1. 347. Falcaria; Rivin. Pentap. Irr. t. 48. Eryngium montanum; Ger. Em. 1164. Ammi perenne repens, &c.; Morif. sect. 9. t. 8. f. 1.)—Leaflets linear, decurrent, confluent, finely serrated.—Native of Germany, Flanders, Switzerland, France, Greece, and Asia Minor; a hardy perennial, kept chiefly in botanic gardens, flowering in July and August. The root is long and cylindrical, white, friable when dried, said to resemble Eryngo in its sweetish, aromatic, rather acrid, flavour. Herb rigid, smooth, two or three feet high. Stem round, leafy, much branched, terminating in numerous slender umbels of many rays, with small white flowers. The general and partial involueral leaves are numerous, long, and very narrow. The radical leaves have long stalks; the rest shorter more sheathing ones; all are rigid, smooth, ternate in the first instance; the middle leaflet ternate; the lateral ones binate; the external edge of each lateral leaflet strongly decurrent.

12. *S. verticillatum*. Whorled Water-parfneq. Fl. Brit. n. 5. Roth. Germ. v. 2. p. 1. 336. (Sifon verticillatum; Linn. Sp. Pl. 363. Willd. Sp. Pl. v. 1. 1437. Ait. Hort. Kew. v. 2. 146. Lightf. Scot. 1096. t. 35. Engl. Bot. t. 395. Oenanthe millefolii palustris foliis; Morif. sect. 9. t. 7. f. 10. Daucus pratensis; Dalech. Hist. 718.)—Leaflets in numerous, capillary, whorl-like segments.—Native of wet salt-marshes. Plentiful in the western parts of Scotland and Wales; found at Killarney, and in the county of Kerry, Ireland, in 1805, by Mr. J. T. Mackay. It is also reported to grow in France, the Pyrenées, and some parts of Germany. Dr. Roth had, unknown to us, forestalled us in transferring this curious species to *Sium*, before the publication of Flor. Brit. though he had never seen a specimen. Of the propriety of this alteration we have no doubt, the umbels being of numerous rays, with many leaves in their general as well as partial involueral, and the petals heart-shaped. The plant is perennial, flowering in July and August. Root of several fleshy tapering knobs. Stem eighteen inches high, erect, smooth, scarcely branched, and slightly leafy. Leaves numerous, chiefly radical, pinnate, of many pairs of deeply-cut, radiating, plumose leaflets, spreading, so as to seem whorled. Petals white, uniform, and nearly equal. Involueral leaves deflexed, ovate; five or six to the general umbel, more to each partial one. Calyx hardly visible. Fruit roundish-ovate, compressed.

13. *S. grandiflorum*. Large-flowered Cape Water-parfneq. Thunb. Prodr. 50. Willd. n. 10.—“Leaves doubly pinnate; leaflets roundish, with tooth-like segments.”—Found by Thunberg, at the Cape of Good Hope.

14. *S. paniculatum*. Panicked Cape Water-parfneq.—Thunb. Prodr. 51. Willd. n. 11.—“Leaves doubly pinnate; leaflets linear, pinnatifid.”—From the same country.

15. *S. patulum*. Diffuse Cape Water-parfneq. Thunb. Prodr. 51. Willd. n. 12.—“Leaves doubly pinnate; leaflets three-cleft. Branches diffuse.”—From the same country.

16. *S. gracum*. Greek Water-parfneq. Linn. Sp. Pl. 362. Willd. n. 13. (Ligusticum græcum, apii folio; Tourn. Cor. 23.)—“Leaves doubly pinnate; leaflets lanceolate, serrated; the uppermost confluent.”—Native of Greece, according to Tournesort; but we have met with nothing referrible to this species among Dr. Sibthorp’s specimens, drawings, or catalogues, nor have we seen any specimen of the authentic plant. Willdenow, from whom we have taken the specific character, says the flowers are yellow.

17. *S. decumbens*. Decumbent Water-parfneq. Thunb. Japon. 118. Willd. n. 14.—“Leaves doubly pinnate; leaflets three-cleft. Stem decumbent.”—Gathered by Thunberg in Japan, where it is known by the name of *Jingsfaku*, and flowers in March. The stem is small, decumbent. Leaves radical, on long stalks, smooth. Umbel terminal, scarcely compound. Seeds ovate, obtuse, striated, smooth, crowned with the permanent styles. Thunberg.—By the description, we suspect this may be more properly a species of *Hydrocotyle*, but without seeing a specimen, we dare not determine.

18. *S. ficulum*. Sicilian Water-parfneq. Linn. Sp. Pl. 362. Willd. n. 15. Ait. n. 8. Jacq. Hort. Viend. v. 2. 62. t. 133. (Daucus siciliano, con foglie di pastinaca; Zanon. It. 78. t. 30.)—Leaves strongly serrated, doubly pinnate; the lower and uppermost ternate. Umbels terminal, stalked; partial ones very unequal.—Native of Sicily. A hardy perennial, flowering in July and August. The stem is variously branched, erect, leafy, about two feet high, round, solid, smooth. Leaves smooth and shining; their leaflets more or less ovate, acute, copiously, deeply, and acutely serrated, sessile. General and partial involueral of many linear deflexed leaves. Flowers yellow; in some of the partial umbels very few, perhaps solitary. Germen oblong. The genus of this species is rather doubtful, if we attend to its habit; and yet we know not how, by the characters, to refer it elsewhere.

19. *S. asperum*. Rough Cape Water-parfneq. Thunb. Prodr. 51. Willd. n. 16.—“Leaves triply pinnate. General and partial flower-stalks rough.”—Found by Thunberg at the Cape, as well as the two following. We have no information concerning any of them, besides what his *Prodromus* affords.

20. *S. hispidum*. Hispid Cape Water-parfneq. Thunb. Prodr. 51. Willd. n. 17.—“Leaves triply pinnate. Foot-stalks and flower-stalks rough.”

21. *S. villosum*. Villous Cape Water-parfneq. Thunb. Prodr. 51. Willd. n. 18.—“Leaves triply pinnatifid; segments ovate, deeply serrated, villous.”

SIUM, in *Gardening*, contains a plant of the hardy, herbaceous, esculent kind, of which the species cultivated is the skirret (*S. fitarum*).

This plant was formerly much cultivated for the roots, which were eaten boiled and stewed with butter, pepper, and salt; or rolled in flour and fried; or else cold, with oil and vinegar, being first prepared by boiling.

Method of Culture.—It may be raised either by seeds or slips from the roots, but the first is the best method, as in the latter mode the roots are apt to become sticky: the seeds should be sown about the beginning of April, either in broadcast over the surface, or in drills, the ground being previously well dug to a good depth; light and rather moist land being chosen for the purpose. The plants mostly appear in five or six weeks, and when they can be sufficiently distinguished by their leaves, the ground should be well hoed over, in the same manner as for carrots, the plants being properly thinned out to the distance of five

or six inches. The hoeing should be repeated as often as necessary, in dry weather. And in the autumn, when the leaves begin to decay, the roots will be fit for use, and will continue to till the spring.

But in the offset method, the old plants should be dug up in the spring before they begin to shoot, the side shoots being then slipped off with an eye or bud to each, planting them in rows a foot apart, and four or five inches distant in the rows: they should afterwards be cultivated as the others.

These roots are prepared, as has been seen, by boiling, and eaten in the same manner as above, or as carrots and parsneps. They are wholesome, but not held in such request as formerly was the case.

SIUM Nodiflorum, Procrumbent Water-parsnep, in the *Materia Medica*. This plant has been omitted by the London College, in the last edition of its Pharmacopeia, and not, it is thought, without reason, as its pretensions even to the character of an antiscorbutic require confirmation.

SIUMPOUR, in *Geography*, a town of Hindoostan, in Bahar; 25 miles E.S.E. of Doefa.

SIUN, a river of China, which runs into the Han river, near Siun-yam, in Chen-si.

SIUNDO, a town of Sweden, in the province of Nyland; 25 miles W. of Helsingfors.

SIUNISONG, a town of Corea, near the sea; 38 miles W.N.W. of Hoang-teheou.

SIUN-YAM, a town of China, of the third rank, in Chen-si; 20 miles E.N.E. of Hing-ngan.

SIUPH, in *Ancient Geography*, a town of Egypt, in the Saitic nome; the native place of king Amasis, according to Herodotus.

SIUR, a port of Africa Propria, in the gulf of Numidia, between the Lesser Collops, and near the promontory of Hippus, according to Ptolemy.

SIVRAY, in *Geography*. See *CIVRAY*.

SIVREY-fur-Meuse, a town of France, in the department of the Meuse; 3 miles W. of Verdun.

SIUT, *SIOUT*, or, as it is often called, *Affiut*, a town or city of Upper Egypt, and now the most considerable. This character formerly belonged to Girgê, which is still a place of note, but the character of pre-eminence belongs to *Affiut*. It is situated within land a few miles W. of the Nile, on an artificial eminence. The site of this ancient city seems to have been either Antopolis, as Pococke thinks, or more probably, as Strabo intimates, Lycopolis. It is a large, populous, and well-built town; and the manner in which the water is conducted round it is worthy of notice. A canal, dug probably from an early period, parallel to the Nile, in this part of the country washes the foot of the mountains which are near to *Affiut*, and having surrounded that city, and the adjacent villages, descends again into the river. The water, however, is not admitted into it except at a certain period of its increase, and then it overflows all the surrounding lands, and *Affiut* only communicates with the Nile by a road artificially raised above the common level, which leads down to the port where the boats resort, and are laden and discharged; and also by two bridges, the one leading to this road, and the other towards the mountains. This city has increased in population within a few years by the good government of Soliman Bey, who has also adorned it by planting many trees. *Affiut* was formerly known to the Arabic writers by the name of "Haut-e-Sultan," the king's fish, or fish-pond. The reason of the appellation is not ascertained, probably it took its rise from its having been appointed to

supply the king's table with fish. In the mountain above *Affiut* are several remarkable caverns, very spacious, and adorned with hieroglyphics and emblematical figures. Some appear to have been sepulchral, as they contain fragments of the jars, in which were deposited not only the ibis, but cats, dogs, and other animals, whether considered as sacred, or slain to attend their master or mistresses in the other world. In one of these caverns, besides the entrance, there are three chambers hewn in the rock, which is free-stone, one sixty feet by thirty; another, sixty by twenty-six; a third, twenty-six by twenty-five. Further up the mountains there are caverns more spacious even than these. Other cavities have been made by removing the stone for the purposes of building; but they have been afterwards appropriated to various purposes; some for sepulture, as we may conclude from the jars, curiously stopped with bitumen, and others either for religious retirement in a Christian age, or for summer retreats, as they are exposed to the north, and very cool.

Large quantities of fine flax are cultivated in the vicinity of Siout: this commodity and wheat are transported from Upper to Lower Egypt. Salt and other articles are brought in return. From Mecca, by way of Colfeir, are imported Indian goods; and the European articles of broad-cloth, tin, &c. are here rarely seen. The Soudan caravans form a chief support of *Affiut*, which serves to them as a midway station. They assembled in their way to Sennaar, here, and at Manfalout, under the protection of a bey: they then passed nearly south-west into the sandy desert of Libya, to El-wah, the Oasis Magna of antiquity, and so into the great desert of Selima. *Affiut* is regarded as the capital of Middle Egypt, and its population exceeds that of all the towns to the south of Cairo. Mr. Browne inclines to estimate the inhabitants at no less than 25,000. The "sen-jiak," or bey of Saïd, divides the year of his office between *Affiut* and Girgê: the internal government consists of the cadi, assisted by other civil officers; and five cahefs, mostly appointed by Soliman Bey, constantly reside there. It is the seat of a Coptic bishop, but the Copts are not very numerous; the people being chiefly Mahometans. Provisions are considerably cheaper at *Affiut* than at Cairo. Manfalout is at no great distance from *Affiut*: this is a city of considerable extent and population. Between these two cities stands Ben-Ali, a populous town. These three places constitute, with Girgê, the chief marts of the trade of Upper Egypt; 162 miles S. of Cairo. N. lat. 27° 25'. E. long. 31° 38'. Savary. Browne. Sonnini.

SIVENS, in *Medicine*. See *SIBBENS*.

SIWA, *SIWAH*, *Siouab*, or *See-awab*, in *Geography*, a town of Africa, in the country of Tripoli, on the frontiers of Egypt, supposed by some to be the ancient Mareotis, and by others to be the Siropum of Ptolemy. According to Mr. Browne, this place answers to the description given of the Oasis (see *OASIS*), as being a small fertile spot, surrounded on all sides by desert land. A path, encompassed with date-trees, leads to the town, which gives name to the district. About two miles from this place, after passing along some shady paths between the gardens, Mr. Browne arrived at what were called the ruins, or "birbé;" and was surprised to find himself near a building of undoubted antiquity, and which he has particularly described. It is situated in N. lat. 29° 12'. E. long. 26° 35'. This edifice consisted of a single apartment, built of massy stones, of the same kind with those which compose the pyramids, and covered originally with six large and solid blocks, that reach from one wall to the other; 32 feet long in the clear, about 18 high, and 15 wide. A gate, at one extremity, forms
the

the principal entrance, and two doors also near that extremity open opposite to each other. The other end is quite ruinous, but there is reason to believe that the whole building has never been much larger than it now is. On the exterior of the walls there is no sculpture, nor is there any appearance of another edifice having been attached to it. In the interior are three rows of emblematical figures, apparently designed to represent a procession; and the space between them is filled with hieroglyphic characters: the soffit is also adorned in the same manner; five of the six stones remain entire, but the other has fallen within, and thus the connection is broken. The sculpture is sufficiently distinguishable; and even the colours in some places remain. The soil around seems to indicate that other buildings have formerly existed near this place. In a rock not far distant there are apartments, which have the appearance of places of sepulture. Although they are without ornament or inscription, they seem to have been hewn with some labour. They appear to have been all opened, but no circumstances point out with certainty the uses to which they have been applied. Nevertheless here are many parts of human skulls, and other bones, with fragments of skin, and even of hair, attached to them. All of them appear to have undergone the action of fire; but whether they are the remains of bodies repositied there by a people accustomed to burn the dead, or whether they have been burned in this their detached state by the present inhabitants, it is now difficult to determine. Yet the size of the catacombs would induce one to conclude, that they were designed for bodies in an un mutilated state; the proportions being twelve feet in length, six in width, and about six in height. The number of these caverns may amount to thirty or more.

The Oasis, which contains the town of Siwa, is stated by Mr. Browne to be about six miles long, and four and a half or five wide. Mr. Horneman, who visited this country since Mr. Browne, says, that the principal and fertile territory of Siwah is 50 miles in circumference; but unless there be a mistake in numbers, 50 being inserted instead of 15, which is not improbable, he differs from all others; unless indeed we suppose, that he included the whole district within the surrounding mountains, without considering that between these and the Oasis are extensive plains of barren sand. A large proportion of the space in which Siwa is situated is filled with date-trees, and there are also pomegranates, figs and olives, apricots and plantains; and the gardens are remarkably flourishing. They cultivate a considerable quantity of rice, of a reddish hue, and different from that of the Delta. The remainder of the cultivable land furnishes wheat enough for the consumption of the inhabitants. Here is abundance of water, both salt and fresh; but the springs which furnish the latter are mostly tepid; and such is the nature of the water, air, and other circumstances, that strangers are often affected with agues and malignant fevers. It is observed by the natives concerning one of the springs, which rises near the building above described, that it is sometimes cold and sometimes warm.

The complexion of the people in this district is generally darker than that of the Egyptians; and their dialect is also different. They are not in the habitual use either of coffee or tobacco. The dress of the lower class is very simple, as they are almost naked; and the costume of the inhabitants, as far as it could be discerned, approached nearer to that of the Arabs of the desert than those of the Egyptians or Moors. Their clothing consists of a shirt of white cotton, with large sleeves, and reaching to the feet, a red Tunis cap, without a turban, and shoes of the same colour. Some earthen ware made by themselves, and a few mats, form the

chief part of their household furniture; none but those of the richer class being furnished with copper utensils. They occasionally purchase a few slaves from the Murzouk caravan. Their remaining wants are supplied from Cairo or Alexandria, whither they transport their dates, both in a dry state, and beaten into a mass, which when good resemble in some degree a sweet-meat. They eat no large quantity of animal food, and bread of the kind known to us is uncommon. Flat cakes, without leaven, kneaded and then half baked, form part of their nourishment. The remainder consists of thin sheets of paste, fried in the oil of the palm-tree, rice, milk, dates, &c. They drink, in large quantities, the liquor extracted from the date-tree, which has often the power of inebriating. Their domestic animals are the hairy sheep and goat of Egypt, the ass, and a very small number of oxen and camels. The women are veiled, as in Egypt. After the rains, the ground in the neighbourhood of Siwa is covered with salt for many weeks. Browne's Travels.

SIWA, in *Mythology*, a goddess of the Germans, represented in her statue naked, with her hair falling down behind as far as her knees, and holding in one hand a bunch of grapes, and in the other an apple. She is taken for Venus, or for the goddess of health. Others take her for a rural divinity, the Pomona of Lusatia.

SIWALON, in *Geography*, a rock in the East Indian sea, near the north coast of Java. S. lat. 6° 36'. E. long. 110° 49'.

SIXAIN, SIXTH, *Sextagena*, in *War*, an ancient order of battle, in which six battalions being ranged in one line, the second and fifth were made to advance, to form the vanguard; the first and sixth to retire, to form the rear-guard; the third and fourth remaining on the spot, to form the corps, or body of the battle.

The word is French, signifying the same thing.

SIX-CLERKS, officers in chancery of great account, next in degree below the twelve masters; whose business is to enrol commissions, pardons, patents, warrants, &c. which pass the great seal, and to transact and file all proceedings by bill, answer, &c.

They were anciently *clerici*, and forfeited their places, if they married; but when the constitution of the court began to alter, a law was made to permit them to marry. (Stat. 14 & 15 Hen. VIII. cap. 8.) They are also solicitors for parties in suits depending in the court of chancery.

Under them are six deputies and sixty clerks, who, with the under clerks, do the business of the office.

SIX-FOUR, in *Geography*, a town of France, in the department of the Var; 9 miles S.W. of Toulon.

SIXHINDEMEN. See SYXIHINDEMEN.

SIX-ISLANDS, in *Geography*, small islands in the East Indian sea. S. lat. 6° 37'. E. long. 71° 26'.

SIX-MEN FORT, a fort of the island of Barbadoes; 1 mile N. of Speight's Town.

SIX-MEN'S Bay, a bay on the north-west coast of the island of Barbadoes.

SIX-MILE BRIDGE, a post-town of the county of Limerick, Ireland; 6 miles S. of that city, on the road to Cork, and 102 miles S.W. from Dublin. There is another town of the same name west of Limerick, on the road to Ennis, and in the county of Clare, which is 102 $\frac{3}{4}$ miles W.S.W. from Dublin. The latter town is on the river Gearna or Owgarne, (*i. e.* Owin Gearn, river Gearna,) which falls into the Shannon, where Bunnatty castle stood; and had some ecclesiastical buildings in former days.

SIX-MILE Creek, a small stream in the state of New York, that enters the head of Canoga lake at Ithaca. A part

part of the creek is in the north-east part of Tioga county, where it furnishes excellent mill-seats. Its course is seventeen miles.

SIX-MILE CROFS, a fair-town of the county of Tyrone, Ireland, where there is a church. It is 7 miles S.E. from Omagh.

SIX-MILE WATER, a river of the county of Antrim, Ireland, which rises in Agnew's hill, near Larne, and running south-west, falls into Lough Neagh, below the town of Antrim. The valley of this river, containing several villages, is a fine specimen of the beauty and cultivation of the county, to which the frequent white-thorn hedges contribute not a little; shewing, as the plains about Antrim are approached, the increasing richness of the soil, by their superior size and vigour. Dubourdieu's Antrim.

SIX-NATIONS, a confederacy of American Indians, so called by the British and Americans, and by the French Iroquois. They are Mohawks, Oneidas, Onondagas, Senecas, Cayugas, and Tuscaroras. In the American war they took part with Great Britain, and in 1770 they were totally defeated by the troops of Congress. Many of them have removed to Canada; and in 1796 they amounted to 4058 persons. In this year a society of Friends or Quakers raised a fund, towards promoting the civilization and comforts of these poor people.

SIXT, a town of France, in the department of the Ille and Vilaine; 6 miles N. of Redon.

SIXTH, *SESTA*, Ital., *Sixte*, Fr., in *Music*, the second of the two imperfect concords, called by the Greeks Hexachordon, because its interval is formed of six sounds, or five diatonic degrees. The sixth is only a natural consonance by combination; for in the order of concords there is no simple and direct sixth.

To consider sixths by their intervals, there are four different sorts; two consonant, and two dissonant. The consonant are, first, the *minor* sixth, composed of three tones, and two major semitones; as E C: its ratio is 5 to 8. Secondly, the *major* sixth, composed of four tones, and a semitone major; as G E: its ratio is 3 to 5.

The dissonant sixths are the extreme flat, and the extreme sharp sixths; as B b and G *, called by the French the superfluous sixth; and C * and A b. Neither of these intervals can be used in melody, and only the first in harmony.

Dr. Pepusch has given eight examples of the allowable use of the sixth in two parts; and Rousseau has given a list of seven chords, in which sixths are employed. These are, first, the simple chord of the sixth to the third of a key, when that third is the supposed base, instead of its fundamental. This kind of chord, which is the common chord to the third below the base, may be given likewise to the second and the sharp seventh of a key. The second use of the sixth is with the fourth, which is still a perfect concord to the fifth below the base. The third use of the sixth is in the chord of the $\frac{6}{3}$, which is the chord of the seventh to the fifth below the base, with a sharp third. The fourth use of the sixth is in the chord or harmony of the $\frac{6}{4}$, which is the chord of the seventh to the minor third below the base. This harmony is usually given to the fourth of a key.

The fifth use of the sixth is in what Rameau calls *le double emploi*, or double use of the $\frac{6}{4}$; when either of these intervals may be regarded as the discord. If the fifth is made a discord by the sixth, it must be resolved by *descending* on a concord; but if, as before a close, the sixth is regarded as

the discord, it must be resolved by *ascending* to another fifth, while the fifth remains for a fourth to the next base. See *DOUBLE EMPLOI*, and *RESOLUTION*.

The sixth use of the sixth is that of the major sixth and false fifth, which is the chord of the extreme flat seventh to the second of a minor key, in which the false fifth is taken, instead of the fourth.

Lastly, the seventh use of the sixth is in the chord of the extreme sharp sixth, used only to the sixth of a minor key; as D * to F b, when the base descends to E, the fifth of the key, with a sharp third. This is an original chord, which cannot be inverted. All these chords will be given in notation on the music plates, in the rules for accompaniment, or thorough-bass. The major sixth is nine semitones or half notes above the base; the minor sixth, eight.

The sixths major and minor, being inversions of the thirds in composition and accompaniment, may, in two parts, move in succession upwards and downwards at pleasure. It has, in a regular descent, a solemn and melancholy effect, more pleasing than in a regular ascent. In composition and accompaniment, this concord is accompanied by the $\frac{3}{2}$, or by its octave and a third, or by two thirds. In thorough-bass, doubling the sixth or third, when the movement is not very rapid, enriches the chord and the harmony more than the eighth.

SIXTH, in the *Military Art*. See *SIXAIN*.

SIXTH PAIR OF NERVES. See *NERVE*.

SIXTH RATES. See *RATE*.

SIXTUS I., pope, in *Biography*, was by birth a Roman, and succeeded Alexander I. about the year 119. Very little is known concerning him; and though there are two decretals ascribed to him, they are generally regarded as forgeries. He died in the year 128, and has been ranked among the martyrs by the church of Rome, though it is not at all ascertained that he actually ended his life by martyrdom.

SIXTUS II., pope, was a deacon of the Roman church at the time he was elected to the pontificate, in the year 257, or, according to some authors, in 260. At the request of Dionysius, bishop of Alexandria, he put an end to a dispute commenced between his predecessor, Stephen, and St. Cyprian, concerning baptism administered by heretics. A persecution was at this time raging against the Christians in consequence of a rescript of the emperor Valerian, directing that search should be made for all bishops, priests, and deacons, in order to be put to death. Sixtus was one of the first victims, being beheaded after he had occupied the papal chair almost a year.

SIXTUS III., pope, a Roman, was long regarded as one of the principal ornaments of the church of Rome. In 418 he was a favourer and protector of the Pelagians; but when their opinions were condemned by Zosimus, he was one of the first who pronounced an anathema against them, and made a public declaration of his orthodoxy. He was raised to the pontifical throne in 432, on the death of Celestine. It was about this period that the Eastern churches were divided concerning the condemnation of Nestorius; Cyril, with the Egyptian bishops, maintaining the justice of that act; while John of Antioch, and other Oriental bishops, refused to concur in it. By the exertions of Sixtus the parties were reconciled. The Illyrian bishops made an attempt in the pontificate of Sixtus to free themselves from the papal jurisdiction, but they were induced by his letters to renounce their purpose. The munificence of this pontiff was displayed in various repairs and rich decorations of churches in

Rome. He died in 440, after a reign of eight years, and his name has been enrolled among those of the saints of the holy Roman see.

SIXTUS IV., pope, who assumed the name of Sixtus, instead of Francis della Rovere, was descended from a family of the same name in Savona, in the state of Genoa. He was born in 1414, and at an early age entered into the Franciscan order. He studied in the universities of Pavia and Bologna, and having taken the degrees of doctor of philosophy and theology, he gave public lectures in several of the principal cities of Italy, and acquired great reputation for learning. Having passed through some honourable offices in his order, he was at length raised to the head of it as general; and becoming known to cardinal Bessarion, through his recommendation, and that of cardinal Gonzaga, he was promoted by pope Paul II., in 1467, to the purple, by the title of St. Peter ad Vincula. On the death of the pope, in 1471, he was raised to the pontifical chair; but on his coronation a tumult was excited that had nearly proved fatal to him. Escaping from the hands of the mob, he attempted to form a league among the Christian princes against the Turks, who had made themselves masters of Bosnia, Iltria, and great part of Dalmatia, and threatened Italy. With this view he sent some of his most distinguished cardinals as his legates to different courts, with instructions to endeavour to compose the disputes existing between the several sovereigns; but, as usual in such cases, with small effect. He procured to be fitted out an allied fleet of galleys, which recovered Smyrna from the Turks, but he did little besides. He was more successful at home, in an attempt to expel a number of petty tyrants who had seized upon the cities belonging to the church, and governed them as independent sovereigns. With the aid of Ferdinand, king of Naples, he effectually cleared the ecclesiastical states of these usurpers, and thereby almost doubled his revenue. The year 1475 was that of the Jubilee, which was celebrated with great magnificence by Sixtus, and was dignified by an unusual assemblage of crowned heads, though the resort of pilgrims in general was less than on former occasions.

This pontiff carried the vice of nepotism to as great a degree as any of his predecessors, and it was one of his first objects to make a splendid provision for his natural children, under the name of nephews, out of the dignities and offices of the church. It is said, that one leading motive for his expelling the independent possessors of towns in the ecclesiastical state was, that he might have territories to form principalities for his nephew; and in pursuance of this plan, he sent Giulano de Rovere, afterwards Julius II., to take the city of Castello from Niccolo Vitelli. Niccolo, having obtained the assistance of the duke of Milan and the Florentines, made a vigorous resistance, but was at length obliged to capitulate. This produced an alarm in the neighbouring states, and occasioned a defensive league between the duke of Milan, the Venetians, and the Florentines. The latter people were under the influence of Lorenzo de Medici, whose political conduct could not but be highly displeasing to the pope; and he displayed his resentment by depriving Lorenzo of the office of treasurer of the holy see, which he had conferred upon him in the days of their friendship. This, however, was not sufficient, and he determined upon an attempt entirely to subvert the power of the Medici in Florence. In conjunction with his nephew, Girolamo Riario, he formed a most detestable conspiracy. By means of the powerful family of the Pazzi, rivals to the Medici in Florence, a revolution was to be effected in the government of that city, commencing with the assassination of Lorenzo and Giuliano

de Medici, when assisting at mass in one of the churches, and the elevation of the host was to be the signal. Fortunately their plans miscarried, but the pope thundered out an excommunication against Lorenzo and the magistrates of Florence, and laid the city and its territories under an interdict. Having in vain endeavoured by menace to induce the Florentines to deliver up Lorenzo, he formed a league with the king of Naples, whose troops, in conjunction with those of the church, invaded the territory of Florence, and spread devastation through it. They were, however, encountered by an opposite league, and the pope was at length, by the interposition of the king of France, and the alarm excited throughout Italy in consequence of the capture of Otranto by the Turks, obliged to consent to a peace. Italy did not long remain in peace. In 1482, Sixtus joined with the Venetians in an attempt to dispossess the duke of Ferrara of his territories, for which his motive was a hope of vesting the government of that city in one of his own family. The consequence was an invasion of the ecclesiastical state by the duke of Calabria, son of the king of Naples, which however terminated in the duke's total defeat. The success of the Venetians rendering them formidable to their neighbours, a league was formed against them, which the pope was persuaded to join, and he issued a solemn excommunication against his allies. The confederates, however, receiving proposals from the Venetians, concluded a peace without consulting Sixtus. This affected his holiness so much, that it occasioned a severe fit of the gout, which put an end to his life in 1484, just after he had completed his 70th year, and in the 13th of his pontificate. "Sixtus IV." says his biographer, "ranks among the most unprincipled of the Roman pontiffs with respect to political conduct, which seems to have been governed by no other motive than the passion for aggrandizing his family, and indulging a rapacious disposition. His concurrence in the detestable conspiracy of the Pazzi, and the eagerness with which he fermented the wars which disquieted Italy almost through the whole of his reign, shew him to have been steeled against all sentiments of public justice and humanity. He has been taxed with avarice, but the imputation has been refuted by recounting the splendid edifices, and the numerous charitable and useful establishments of which he was the founder. He was, in truth, liberal and magnificent in his expenditure; and having, like many other arbitrary princes of that character, exhausted his resources, he scrupled no means of replenishing them. In no pontificate were the offices and employments about the papal court more shamelessly set to sale, or the exactions in passing bulls and other official instruments from that court more scandalously augmented. The most favourable light in which he can be viewed, is as a munificent encourager of literature. He may almost be regarded as the founder of the Vatican library, for he not only enriched it with books, collected from various parts of the world, but caused them to be properly disposed for the convenience of the public, to which he opened the library, placed them under the care of men deeply learned in different languages, with competent salaries, and assigned funds for the purchase of new books. It is, on the other hand, to be mentioned, that he was the first who instituted inquisitors of the press, without whose licence no work was suffered to be printed." Sixtus was author of some theological pieces: several of his letters are extant, and he published some decrees, one of which had for its object to put an end to the disputes then subsisting relative to the conception of the Virgin Mary.

SIXTUS V., pope, was born in 1521, in the Marche of Ancona, at La Grotte, a village in the territory of Montalto.

talto. His father, whose name was Peretti, was a vine-dresser, who not being able to maintain his son, placed him, when he was only nine years old, in the service of a farmer, by whom he was, at first, chiefly employed in attending to his swine. While he was occupied in this low office, a Franciscan friar passing that way, took the lad for his guide on a journey to Ascoli. Pleas'd with the boy's vivacity, he caus'd him to accompany him to his convent, and introduced him to his father guardian, who admitted him into the convent in the quality of a lay brother. He soon manifested a great inclination for learning, and was taught the elements of the Latin language. He was soon admitted into the order, went through the usual courses of philosophy and theology, was ordained priest in 1545, and shortly afterwards, being made a doctor in theology, he was appointed to a professorship at Sienna, under the name of Montalto. He acquired a high reputation as a preacher in several Italian cities, and was in a very short time nominated commissary-general at Bologna, and inquisitor at Venice. In the exercise of the latter office he quarrell'd with the senate, always jealous of ecclesiastical authority, and thought proper to make his escape from Venice by night. Going to Rome, he became one of the council of the congregation, and afterwards procurator-general of his order. He accompanied cardinal Buoncompagno to Spain, in quality of theologian to the senate, and counsellor of the holy-office. Thus elevated, he suddenly changed his demeanour, which had been harsh and petulant, and put on an appearance of extraordinary gentleness and humility. Cardinal Alexandrini, formerly his pupil, being rais'd to the papal dignity by the name of Pius V., sent him the brief of general of his order, and soon after honoured him with the purple, when he took the name of cardinal Montalto. The successor of Pius was Gregory XIII., formerly cardinal Buoncompagno.

Montalto, without influence or connections to push him forward at the next vacancy, determin'd to appear entirely void of wishes and expectation of farther elevation, in order that he might not become an object of jealousy to any party. He accordingly withdrew from all public affairs, shut himself up like one entirely devoted to study and religious retirement, and ever complain'd of the infirmities of age hanging heavily upon him. Gregory died in 1585, and the cardinals split into factions. Montalto appear'd, but in the character of one bending under the weight of years, and as if ready to expire. In the course of the contests, which were long and severe, he was inform'd that the choice would probably fall on him; to which he replied by averring his own unfitness for the office; that his life would scarcely outlive the conclave; and that if he were elect'd, he should only be pope in name, while all the authorities must devolve upon others. This sort of argument, which he threw out as a bait to his ambitious brethren, was readily seized upon by them all, as well with the hope of a short pontificate, as with the expectation that they should all strengthen themselves against a new election. Montalto was chosen on the 24th of April, 1585. Scarcely, however, had the tiara been placed on his head, when he threw away his crutches, which had enabled him to assume his former character, walk'd perfectly erect, and chanted *Te Deum* with a voice so strong, that the roof of the chapel in which the ceremony was performed re-echo'd the sound. He also gave his benediction to the people with such an air of vigour, that they could scarcely believe him to be the decrepid cardinal Montalto. It was now that he assumed the name of Sixtus V., and he soon shew'd them that his mind

was as vigorous as his body. The territory of the church was at this time overrun with banditti, who plundered and even murdered the people with impunity; and in the metropolitan city itself, a relaxed police had encouraged all kinds of disorders. The first object of Sixtus was to exterminate these evils, and no sovereign ever employ'd the corrective powers with which he was invest'd with more vigour and effect. It had been usual, for the sake of acquiring popularity, on the election of a new pope, to set the imprison'd criminals at liberty; but the first act of Sixtus was to order four persons to be hang'd, on whom were found, a few days before, prohibited weapons. This system of rigour he pursu'd with the most inexorable severity, never, in a single instance, pardoning a criminal. There is no doubt that signal severity was necessary to stop the public disorders, and in that view of the subject, Sixtus was certainly a benefactor to the state; but unfortunately for his character as a just magistrate, in whom compassion should be found tempering the rigour of the law, instances are recorded on the page of history which go to prove that he took a real pleasure in acts of punishment, and that his soul was insensible to all the emotions of tenderness and pity; which, says a good writer and diligent observer of human nature, "is not an unusual effect of a monastic education."

A Spanish gentleman having been struck by a Swiss guard with his halberd in a church, retaliated by a blow which prov'd fatal to the soldier. Sixtus, having examin'd into the affair, gave an order to the governor of Rome to have the offender executed before he should sit down to table. The Spanish ambassador, with four cardinals, wait'd upon his holiness, not to plead for the criminal's life, but to entreat upon their knees, that, as he was a gentleman by birth, the punishment might be commuted to that of decapitation: this small favour he absolutely refus'd, and said in a tone of anger, bordering on frantic rage, "he shall be hang'd; but to alleviate the disgrace incurred by his family, I will do him the honour to assist at his execution." He accordingly order'd the gallows to be erect'd before his own house, and was witness to the deed of horror. When the sentence was executed, he turn'd with the utmost coolness to his domestics, and said, "Bring me my dinner; this act of justice has given me an additional appetite." He caus'd the heads of all those who had suffer'd the penalty of death for crimes committed against the state, to be plac'd on the city gates, and on each side of the bridge of St. Angelo, and sometimes went on purpose to view them; and a request being made by the conservators of the health of the city for their removal, when they, by their numbers and decay, became offensive, he replied, "You are too delicate; the heads of those that rob the public are still more offensive."

Another anecdote is told of him, to shew that he was not more rigorous to his own subjects, than strenuous in maintaining the rights and authority of the holy see, with respect to foreign powers. When the ambassador of the king of Spain present'd him with a beautiful genet and a purse of ducats, as a homage due for the kingdom of Naples, and complimented him in his master's name, Sixtus, in a tone of raillery, said, that the compliment was very fine, but that it would require a deal of eloquence to persuade him to take a horse in exchange for the revenues of a kingdom. At the time of his accession, France was in confusion on account of the machinations of the Catholic league to exclude from the crown Henry, king of Navarre, its presumptive heir. Though Sixtus did not approve the attempts of the Guises, at the head of the league, to ob-

tain a superiority over the king, Henry III.; yet he thought it became him, as head of the Catholic religion, to promote the exclusion of a Protestant heir, and he accordingly launched an excommunication against the king of Navarre, depriving him of the right of succession. That prince procured an appeal from this sentence to be fixed on the very gates of the Vatican, which act, Sixtus had the magnanimity to be pleased with, on account of the heroism which it displayed. When Henry III. had caused the duke of Guise to be assassinated, and the cardinal of Guise to be put to death, and the cardinal of Bourbon and the archbishop of Lyons to be imprisoned, the pope, highly incensed at the violation of the ecclesiastical immunities in the persons of the three last mentioned persons, issued a monitory, requiring the king to set at liberty the cardinal and archbishop within ten days, on pain of excommunication; and he afterwards approved, in an open manner, the assassination of Henry by the Dominican Clement. He refused, however, to renew the excommunication of Henry IV., saying, that he would pray for his conversion, and that no prince was more deserving a crown. He had also a high veneration for the character of queen Elizabeth of England, on account of the prudence and vigour of her government, though he was under the necessity of treating her as an enemy on account of her enmity to the Catholic religion. It is said, and the fact is surely quite in character, that he envied her the good fortune in having had the pleasure of taking off a crowned head, by the execution of Mary, queen of Scots. After the defeat of the Spanish armada, he entertained the design of wresting the kingdom of Naples from Philip, but was prevented by death from making the daring attempt.

It was the ruling passion of this pontiff, who, as we have seen, was only a peasant's son, to perpetuate his memory, by which he was led to many vain and ostentatious, and to some great and useful enterprises. He had already, while cardinal, engaged the celebrated architect Fontana, in erecting a splendid chapel in the church of St. Maria Maggiore, which he had been obliged to discontinue, from the withdrawing of his allowance by Gregory XIII.; and now having the means, as well as the good will, he employed the same artist in the arduous task of setting upright the fallen obelisk of Egyptian granite, which had once decorated the Circus of Nero. This was effected by great skill and labour, and the obelisk was dedicated by Sixtus to the Holy Cross. He afterwards caused three other obelisks to be dug out of the ruins among which they lay, and placed before different churches. If mere vanity and ostentation led him to erect useless buildings at his native place; it was universally allowed, that use and ornament were united in most of the works which he executed at Rome. For the supply of water to that metropolis, he directed the collection of a number of springs to one reservoir, at the distance of thirteen miles, whence it was conveyed by an aqueduct to the Quirinal mount. He undertook to rebuild the Vatican library upon an enlarged and more magnificent plan, by his favourite architect Fontana, and erected very near it a very fine printing-office, destined to give splendid as well as correct editions of the fathers, and other works relative to religion. There was not a part of Rome to which he had not given decorations, and perhaps no pope left so many monuments of grandeur after a long reign as Sixtus V., after occupying the papal see little more than five years. On these objects he must have expended immense sums, yet at his death he left five millions of crowns in the castle

of St. Angelo, with an injunction to his successor, that they should be expended only for the service of the church, against Turks and heretics, or to relieve the people in times of famine and pestilence. For the supply of the great expenditure of his reign, and the accumulation of the sums left behind him, he must have had recourse to a system of heavy taxation, although he managed his finances with great economy. He was not free from the papal vice of nepotism. Though never ashamed of the meanness of his origin, which could not be concealed, he was determined to leave his family great. He sent for a sister, the widow of a poor countryman, and instantly gave her the rank of a princess, with a suitable maintenance; and he raised one of her grandsons to the cardinalate, with a very large revenue. He was equally liberal to his other relations. He fixed the number of cardinals to seventy, a number which has been adhered to by his successors; and he decreed, that four at least of the number should be doctors of divinity, chosen from the religious orders. He is said to have been a decided enemy to the Jesuits, and was indignant that they should assume a name that implied, that their founder was the meek and benevolent Jesus; hence he proposed that they should change the name of their order to that of Ignatians. This celebrated pontiff died in August 1590, having reigned five years and four months. The news of his death was received with every demonstration of joy at Rome, where his government had been oppressive and tyrannical; but the vigour of his administration, and the mighty works which he effected, have thrown a splendour about his name, and gave him rank among the distinguished characters of the age. In the year 1590, a new Latin version of the Bible was made and printed by his order, of which a corrected edition was given in 1592, by Clement VIII.

SIZADA, in *Geography*, a town of Hindoostan, in Allahabad; 20 miles S.E. of Corah.

SIZANDRO, a river of Portugal, which runs into the Atlantic, N. lat. 39° 2'. W. long. 9° 19'.

SIZE, the name of an instrument used to find the big-ness of fine round pearls.

It consists of thin pieces, or leaves, about two inches long, and half an inch broad; fastened together at one end by a rivet. In each of these are several round holes drilled, of different diameters. Those in the first leaf serve for measuring pearls from half a grain to seven grains. Those of the second, for pearls from eight grains, or two carats, to five carats, &c.: and those of the third, for pearls from six and a half to eight and a half.

SIZE is also used for a kind of weak glue. (See GLUE.) The shreds and parings of leather, parchment, or vellum, by being boiled in water and strained, make size. Common size is made of leather boiled in water till it becomes of a viscid consistence. If it is wanted in painting for nicer purposes, it should be prepared by taking any quantity of the shreds or cuttings of glovers' leather, and putting to each pound a gallon of water; let these be boiled for six or eight hours, supplying water, so that it may not diminish to less than two quarts. Then strain the hot fluid through a flannel, and afterwards evaporate it till it is of the consistence of a jelly when cold. The size used in burnish gilding, and made of cuttings of parchment, is prepared much after the same manner. This substance is useful in many trades. Mr. Boyle mentions, among other uses, that fine red stands, and hanging-shelves, are coloured with ground vermilion tempered with size, and when dry, are laid over with common varnish.

SIZE, *Gold*. See GOLD-SIZE.

SIZE, *Inglass*. See *ICHTHYOCOLLA*.

SIZE, *Painting*. See *DISTEMPER*.

SIZE for *Silvering*. See *SILVERING*.

SIZE of *Cottage Grounds*, in *Agriculture*. See *COTTAGE*.

SIZE of *Farms*, the particular dimensions or extents of them. The advantages of the different sizes of farms, so far as they relate to the occupiers and the community at large, have not yet been by any means ascertained. See *FARM*.

SIZE of *Fields or Inclosures*. See *FENCE, FIELD, and INCLOSING of Land*.

SIZEBOLI, in *Geography*, a town of European Turkey, in Romania, on a point of land which projects into the Black sea, with a good road, in which men of war may moor. It is the see of a Greek archbishop; 14 miles E. of Burgos. N. lat. $42^{\circ} 30'$. E. long. $27^{\circ} 44'$.

SIZEL, in *Coining*, is used where pieces of money are cut out from flat bars of silver, after having been drawn through a mill into the respective sizes or dimensions of the money to be made; the residue is called fizele, and melted down again.

SIZING, in *Mineralogy*, a term used by the Cornish miners for a peculiar method of separating the purer from the impurer parts of an ore, by means of sieves. When the ore has been powdered, they put it into a wire-sieve with fine holes, and in this they sift it, till the fine part goes through: this is properly what is called sizing. They send the larger or coarser part to be powdered again, and putting the rest into a sieve with a close bottom, they let in a stream of water from the cock, and by means of continued shaking it about, they cause the lighter and fouler parts to be washed over the rims of the sieve, and the remaining powder is the black tin.

SIZRAN, in *Geography*, a town of Russia, in the government of Simbirsk, on the Volga; 27 miles S. of Simbirsk. N. lat. $53^{\circ} 10'$. E. long. $48^{\circ} 14'$.

SIZUN, a town of France, in the department of Finistère; 6 miles S.E. of Landerneau.

SIZZELA, a town of Istria; 9 miles S.S.W. of Cape d'Istria.

SIZZING, in *Rural Economy*, a term provincially applied to yeast or barm.

SKABOUGAN, in *Geography*, a river of America, which runs into lake Michigan, N. lat. $44^{\circ} 5'$. W. long. $86^{\circ} 46'$.

SKAGAFIORD, a bay on the N. coast of Iceland. N. lat. $65^{\circ} 50'$. E. long. $15^{\circ} 21'$. This Fiord receives the waters of two rivers, one of which is large, and is called Kolbeinsdalfaa. On the western side of the Skagafiord is situated a place of trade, called Hoffos, with a bad harbour, so that only one merchant has settled there. At the head of the Skagafiord, not far from Hoffos, is Hoolum, which, until the close of the last century, was the seat of one of the bishops of Iceland. A public school was also established there; but now (1810) the place consists only of a few cottages; and in its present state contains nothing particularly worthy of notice.

SKAGAFIORD *Syssel*, a district of Iceland, containing 412 farms, 492 families, and a population of 3141 persons.

SKAGASTRAND, a considerable place of trade on the northern coast of Iceland; situated on the western side of the large promontory which bounds the Skagafiord. The harbour is bad; and towards the end of September is particularly unsafe, on account of its being exposed to the north wind and floating ice. This place formerly furnished a cargo for one vessel every year; but since the commence-

ment of the war, the arrival even of one ship has not been regular.

SKAGEN, a promontory of Iceland, projecting from the N. coast, about 20 miles in length from N. to S. and from 5 to 15 in breadth; the N. point being in N. lat. 66° . E. long. $45^{\circ} 51'$.

SKAGEN. See *SCAGEN*.

SKAGER, a town of Sweden, in West Gothland; 85 miles E.N.E. of Uddevalla.—Also, a lake of Sweden, in Warmeland; 5 miles E. from the Wenner lake.

SKALDA and SKALDS. See *EDDA* and *SCALDS*.

SKALE, in *Geography*, a small island on the W. coast of Scotland, in Loch Fine. N. lat. $55^{\circ} 54'$. W. long. $5^{\circ} 23'$.

SKALEN, a town of Prussia, in the palatinate of Culm; 13 miles N. of Strasburg.

SKALEVAD, a town of Sweden, in the province of Angermanland; 50 miles N.N.E. of Hernofand.

SKALGRUND, a small island on the E. side of the gulf of Bothnia. N. lat. $55^{\circ} 54'$. W. long. $5^{\circ} 23'$.

SKALHOLT, a town of Iceland, the see of a bishop, suffragan of Drontheim. N. lat. 64° . W. long. 16° . The situation of Skalholt, about 24 miles from Thingvalla (which see), is beautiful. Towards the south there is a view of a noble river, formed by the junction of that discharged from Apa Vatn and the Huitea, bounded by a finely-shaped hill in the distance; another equally picturesque hill rising on the eastern bank of the latter, and facing Skalholt. Flat meadow land, gently swelling ground, and distant mountains towards the east, among which are Eyafialla Jokul, and Hekla, form altogether a magnificent amphitheatre, and compose a landscape which, even without wood, is highly gratifying to the eye. The first bishop of Skalholt was Isleif, who died in 1080; he was the earliest of the Icelandic historians, and a man of great general learning; but his works are now unfortunately lost. Paul, another bishop of Skalholt, as well as Sturleson, were distinguished by their attainments in mathematics and mechanical science. During a period of seven centuries, Iceland was divided into two bishoprics, that of Skalholt comprehending the southern, and that of Hoolum the northern districts of the island. The sees becoming vacant at the same time, they were united, in 1797, by the order of the Danish government; and the title of bishop of Iceland was conferred upon the learned and respectable Gein Vidalin, the present possessor of this dignity. The duties of his office are important and extensive. The place of his stated residence is Reikiavik. His revenue, since the union of the sees, is about 1800 dollars *per annum*, derived chiefly from the public treasury of the island. The appointment of the bishop is vested in the crown. The church of Skalholt is a neat small building of wood, erected on the site of the former one, which was taken down about the year 1804. The church, the bishop's house, and a few cottages, constitute the supposed capital of Iceland. The easiest route from the southern to the northern parts of Iceland is by the way of Skalholt. To Skagaltrand, the nearest road is by Thingvalla and Kalmanlunga, which last place is situated to the N.E. of Reikholt. See Mackenzie's Travels in Iceland in 1810. See *ICELAND*.

SKALL, a town of Bohemia, in the circle of Boleslaw; 4 miles N.N.W. of Turnau.

SKALLERUD, a town of Sweden, in the province of West Gothland; 50 miles N.N.E. of Uddevalla.

SKALOE, a small island of Denmark, near the N. coast of Laaland. N. lat. 55° . E. long. $11^{\circ} 23'$.

SKA-

SKANANDO CREEK, a small water of Oneida creek, which rises in Augusta, Oneida county, runs northerly through the said town and Vernon, and enters Oneida creek near the S.W. corner of Vernon. It furnishes good mill-seats in Augusta and Vernon. Its course is about four miles.

SKANDA, in *Hindoo Mythology*, is a name of Kartikya, commander of the celestial armies. He is a reputed son of Siva, and his history and exploits fill many volumes of Eastern poetry, translated into a variety of languages from the Sanscrit. He is also called Divimatri, having the same meaning in Sanscrit, as Dimeter or Bimeter among western mythologists. Shanmuka, or six-faced, Sestimatriya, meaning with six mothers, are others of his names; the origin of which will be found under those articles, and KARTIKYA. (See also SIVA.) Sir W. Jones informs us that the Persian poets, in borrowing their romantic histories from those of India, have ridiculously confounded the Skanda of the latter with Skander or Ilkander; their name of Alexander the Macedonian, as well as of a hero in their earlier romances.

SKANDERBORG, in *Geography*, a town of Denmark, in North Jutland, where the kings of Denmark have a royal palace: the chief trade of the inhabitants consists in the produce of the country, and agriculture; 10 miles S.S.W. of Aarhus. N. lat. $56^{\circ} 55'$. E. long. $9^{\circ} 54'$.

SKANEATETES, a lake of New York; 25 miles S.S.E. of lake Ontario.

SKANGERO, a small Grecian island below that of Pelagnisi, and near the isle of Dromi, in which are two rocks, called the "Brothers."

SKANKHEADHAW LAKE, a lake of North America. N. lat. $49^{\circ} 45'$. W. long. $90^{\circ} 45'$.

SKANO, a town of Sweden, in Schonen; 20 miles S.S.W. of Lund. N. lat. $55^{\circ} 24'$. E. long. $12^{\circ} 34'$.

SKANTZE, a town of Sweden, in Westmanland; 9 miles N. of Stroemsholm.

SKAPTAA-JOKUL, lofty mountains situated in the interior of Iceland, and known to the natives themselves only by the remote view of their summits, clad in perpetual snows. These were the scene of a most dreadful volcanic eruption in the year 1783. This is represented as the most tremendous, perhaps, in its nature and extent, by which Iceland, or any other part of the globe, has been afflicted. The sudden extinction of a submarine volcano near Cape Reikianes, which, during some months, had continued to burn with extreme violence, was succeeded by frequent and dreadful earthquakes, and by the bursting out of the volcanic fire, in a tract of country nearly 200 miles distant. From this desolate and unfrequented region vast torrents of lava issued forth, overwhelming all before them, and filling up the beds of great rivers in their progress towards the sea. For more than a year, a dense cloud of smoke and volcanic ashes covered the whole of Iceland, obscuring almost entirely the light of the sun, and extending its effects even to the northern parts of continental Europe: the cattle, sheep, and horses of the country were destroyed; a famine, with its attendant diseases, broke out among the inhabitants; and the small-pox invaded the island at the same time with its former virulence and fatal effects. From these combined causes, more than 11,000 people perished during the period of a few years; an extent of calamity which can only be understood, by considering that this number forms nearly a fourth part of the whole present population of the country. The destruction of the fishery upon the southern coasts of the island, by the volcanic eruptions just described, was another more permanent source of distress, which, even

at the present time (1810) is not entirely removed. Maekenzie's Travels in Iceland.

SKAPTAFELL, EAST, a district of Iceland, on the northern coast, containing 53 farms, 126 families, and a population of 911 persons.

SKAPTAFELL, West, a district of Iceland, on the same coast, containing 133 farms, 248 families, and 1539 inhabitants.

SKARA, a town of Sweden, in West Gothland, the most ancient town of the country, and formerly the capital of the kingdom of Gothland, and the residence of many of its kings. It had also several churches and convents, the ruins of which are still visible. The town was totally destroyed by fire in 1719; and the number of its inhabitants does not at present exceed 400. Its gymnasium or seminary was established in 1640, and its cathedral is one of the largest edifices of the kind in the whole kingdom. In 1611 the royal palace, built near the town in 1545, together with the whole town, was reduced to ashes by the Danes. At a distance from it stands Brunso, an episcopal see; 50 miles E. of Uddevalla. N. lat. $58^{\circ} 24'$. E. long. $13^{\circ} 30'$.

SKARDSA, BIORNO á, in *Biography*, a learned Icelander, was born at Ingelvelt in 1574. Having lost his father at eight years of age, he was placed by a relation under the care of Segurd Jonsen, who being well versed in the ancient history of the country, inspired Biorno with a strong taste for that kind of study. On the death of his master, in 1602, Biorno married, and having already been elected a magistrate, he applied himself with great diligence to history and jurisprudence. In old age he was borne down with heavy and very severe afflictions, became blind, and died a martyr to the stone in 1655. He collected a variety of documents and curious facts relating to the history of Iceland, and was, on account of his great knowledge in this department of learning, held in high estimation by his countrymen. His chief publication was "The Annals of Biörn à Skardsa, five Annales, &c. cum Interpretatione Latina, variantibus Lectionibus, Notis et Indice." He left behind him a great number of manuscripts, both juridical and historical, a catalogue of which may be seen in the Ecclesiastical History of Iceland by Johannæus; in Einarus' Literary History; and in the preface to the second volume of his Annals. Among his MSS. is one respecting Iceland, of which Torfæus made great use in his "Grönlandia Antiqua." Gen. Biog.

SKARDUPONEN, in *Geography*, a town of Prussian Lithuania; 1 mile N.W. of Stalluponen.

SKARO, a town of Norway; 32 miles N. of Stavanger.

SKARROE, a small island of Denmark, near the S. coast of Fyen; 6 miles S. of Svenborg. N. lat. $55^{\circ} 1'$. E. long. $10^{\circ} 29'$.

SKARSTÅ, a town of Sweden, in West Gothland; 40 miles E. of Uddevalla.

SKATE, in *Ichthyology*, the English name of a species of ray-fish, called by the generality of authors *raia undulata*, and *raia levis*, and by some *rubus*.

It is distinguished by Artedi by the name of the variegated ray-fish, with the middle of the back smooth, and with only one row of spines in the tail.

This species, which is the *RAIA Batis* of Linnæus, (see RAIA,) is the thinnest, in proportion to its bulk, of any of the genus, and also the largest, some weighing near two hundred pounds. The nose, though not long, is sharp-pointed; above the eyes is a set of short spines; the whole upper part of a pale-brown, and in some species streaked with

with black; the lower part white, marked with many small black spots; the jaws covered with small granulated but sharp-pointed teeth; the tail is of a moderate length; near the end are two fins; along the top of it is one row of spines, and on the edges are irregularly dispersed a few others. In the males of this species the fins are full of spines. Skates generate in March and April, at which time they swim near the surface of the water, several males pursuing one female. The females begin to cast their purses, as the fishermen call the bags in which the young are included, in May, and continue to do it till September. In October they are very poor and thin, but begin to improve in November, and grow gradually better till May, when they are in the highest perfection. The males go sooner out of season than the females. Pennant.

SKAW, in *Geography*. See SKAGEN.

SKAWIN, a town of Poland; 10 miles S. of Cracow.

SKEATTA, or PENNY, in the *History of Coinage*, one of the Heptarchic coins; the other being the *stycra*, which see. Dr. Combe, by causing two plates of the skeattas, or early pennies, to be engraved, brought them into notice. At first they had only rude figures of serpents, &c. but latterly they have legends. These skeattas were struck in Kent, and the other Heptarchic states, from the sixth to the eighth century, or from about the year 500 till 700. In 598 Kent was converted to Christianity, and was followed in half a century by the other kingdoms. Most of the skeattas, as appears from their symbols, were struck in the Pagan times. See *Modern MEDALS and COINS*.

SKEDE, in *Geography*, a town of Sweden, in Smaland; 42 miles S.E. of Jonkioping.

SKEEL, in *Agriculture*, provincially a large milking pail, having two handles, formed by two opposite staves, which rise above the rest. It also signifies a broad flat creaming or milk-dish, whether of lead or stone.

SKEEN, in *Geography*, a town of Norway, in the province of Christiania; 38 miles S.W. of Christiania.

SKEETS, in the *Sea Language*, narrow oblong ladles, or scoops, for wetting the sails, decks, or sides of a ship.

SKEG, in *Ship-Building*, the after-part of the keel, or that part whereon the stern-post is fixed.

SKEG-Shores, one or two pieces of four-inch plank, put up endways under the skeg of the ship, to steady the after-part a little, when in the act of launching. They are confined to the bottom of the slip by a hinge. The upper part is rounded, and they should be so carefully fixed as to fall readily when the ship starts. Skeg-shores are better avoided, as they have been the means of preventing ships from launching.

SKEGS, in *Agriculture*, a sort of oat, sometimes cultivated as a crop in Nottinghamshire: the *avena stipiformis* of Linnæus. It is paniced, the calyces two-flowered, awns twice as long as the seed, culm branchy, and stipeform. They are a crop mostly cultivated, according to the agricultural report of the above district, on the worst land, sometimes on a lea, sometimes after turnips, often taken as a last crop. On bad land they may produce about four quarters *per* acre, which are generally about two-thirds of the price of oats. But they answer to sow on good land, producing fourteen and fifteen quarters *per* acre. The kernel is reckoned remarkably sweet and good food for horses. They are sometimes threshed, sometimes cut and used in the straw. And they are chiefly grown about Carberton, and will grow where nothing else will. In regard to the quantity of seed *per* acre, eight strikes are said to be sown, and yield a crop double that of other oats, in quantity;

but not more than equal in weight. They will grow in the poorest land, and are reckoned very sweet food. They are seldom brought to market; but esteemed by farmers for their own use, and are often given in the straw by them.

It is stated by Mr. Neville in the same Report, in a letter to sir R. Sutton, that skegs are remarkably good for horses, in the straw, or threshed, and in the straw remarkably so for cows. Straw beats are also very fond of the straw. He can get taking up weak land from the sward, from four to six quarters an acre. On the same land he should not have been able to get, perhaps, above three sacks of black, red Friesland, or what is called short small, or any other kind of corn. If land is in the state in which all our bad land will be, more or less, after the seeds are quite run out, and as is frequently the case, when you cannot conveniently put it again into tillage so soon as you could wish, from either the too great quantity you may have to improve, or other circumstances; if in this state it were to be taken up with turnips, the most eligible way, it would be often impossible to provide manure *upon the farm* for any quantity of land sufficient for the purpose; which makes skegs a very desirable crop, and which, for that reason alone, he finds a great acquisition, and feels a pleasure in having been the first to introduce them into this country.

How far this crop may be capable of being grown in other districts as the food of live-stock, in the green state, must depend upon the trial.

SKEILAY ISLE, in *Geography*, a small island of the Hebrides, is situated near the western entrance of the firth of Harris. It is comprehended in the parish of Harris and shire of Inverness.

SKELBOO, a town of Norway, on the Glanmen; 12 miles N.E. of Frederickstadt.

SKELDNESS, a cape of Scotland, on the S.W. coast of the island of Shetland. N. lat. 60° 12'. W. long. 1° 48'.

SKELEFTEA, a town of Sweden, in West Bothnia, on a river of the same name; 40 miles S. of Pitea.

SKELEFTEA, a river of Swedish Lapland, which rises on the borders of Norway, and runs into the gulf of Bothnia, S.E. of Pitea.

SKELETON, in *Anatomy*, from *σκελετα*, *to dry*, is the assemblage and combination of all the bones in the body, excepting the os hyoides: it constitutes the basis or groundwork of the animal frame, being the point of support and union for all the other organs. Its component parts form a series of levers, of which the muscles are the moving powers: thus the skeleton comprehends one division of the moving organs. Its constituent pieces in some cases form cavities, as those of the head, chest, and pelvis, which contain the important internal organs, and protect them from external force.

The connections of the different pieces of the skeleton are called *joints*, and differ very considerably from each other; some of them admitting no motion, some an inconsiderable motion; and others allowing them to move freely, either in certain directions, or in every way. The word *skeleton*, denoting the bony fabric in its united state, of course includes the joints or media of union; and in this respect we distinguish two kinds of skeletons. A *natural* skeleton is that in which the bones are all joined by their natural connections; that is, the articular ends are covered by their cartilaginous strata, tied together by ligaments, and enveloped by synovial membranes: in this sense the skeleton includes, besides the bony system, the accessory structures of cartilage, ligament, and synovial membranes. When all

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the soft parts have been allowed to putrefy and rot, and the separated bones, after being cleaned and dried, have been joined again by wires, &c. so as to be reunited artificially in their former order, an *artificial* skeleton is formed. In the spine and the ribs, the places of the cartilages, which are lost in cleaning the bones, are supplied by portions of leather, cork, or other materials.

The latter, exhibiting merely the assemblage of the dried bones, is applicable to the study of osteology only in the mechanical points of figure, size, &c.; and although extremely useful to the anatomist and surgeon, by representing the parts in their natural connection and relations, is less convenient than the separate bones for the study of many points, particularly the articular ends of the bones.

For the formation of artificial skeletons, the bones are deprived of their soft parts, either by boiling, or by maceration in water. The boiling must be continued until the tendons, ligaments, periosteum, &c. are so loosened as to admit of being easily detached. The bony texture acquires in this method a dirty and greasy appearance, which cannot be entirely got rid of by any after-process. For the purpose of maceration, the bones, with the flesh, &c. roughly cut off, must be left in the same water for some months; the soft parts will then fall off, and leave the bones of a much better colour, and freer from grease than when they have been boiled. Exposure to the air, and frequently wetting them, will make them beautifully white after they have been well macerated. Their colour may be often much improved by exposure to chlorine (oxymuriatic gas). The bones which possess large medullary cavities should be bored at the articular ends, to get out the fatty substance.

Emaciated and particularly anasarctous subjects are the best for making skeletons; because there is no fat in the bones, and they consequently continue dry and clean, when they have been originally well prepared. Persons dying in good health, or from sudden attacks, have so much adipous matter in the interior of their bones, that they continue greasy, particularly at the articular ends, whatever pains may be taken to clean them.

In natural skeletons, the cartilages, ligaments, and synovial membranes being all left, the joints possess their natural mobility. But in order to keep them in this state, they must be preserved in spirits, or some other fluid capable of preventing the putrefaction of the soft parts. This is particularly necessary with the skeletons of young subjects, which are in great part cartilaginous. When a natural skeleton is dried, the soft parts shrink and are shrivelled up: the cartilages become contracted, and thus the natural figure is greatly impaired. The contraction of the cartilages diminishes the height by an inch or more.

So long as the bones are composed of separate pieces, and have more or less cartilage in their structure, the osseous system can only be studied in natural skeletons; but when the ossification is complete, artificial skeletons are preferable.

The bones, being the levers by which the motions of the body are performed, have the muscles or moving powers fixed to them. But as they are subservient, in the construction of our frame, to other purposes besides those of motion, there are some bones, though very few, to which no muscles are attached: such are the incus in the ear, the ethmoid and inferior turbinated bones, and some bones of the carpus.

Although the form of the bones is variously modified, according to the figure of the parts in which they are placed, or to their destinations, they may be classed under the three

divisions of broad or flat bones, cylindrical bones, and short bones. The broad bones represent flat shells, and consist of an inner stratum of reticular or spongy bony substance, which is covered on its surfaces with thicker or thinner plates of compact bony matter. The cylindrical, or long bones, form long shafts, expanded at their extremities into thicker heads, and containing a medullary cavity internally. The short bones are such as are nearly equal in their length, breadth, and thickness; variously shaped, according to their situations and offices; and consist of the loose spongy texture, covered by a thin rind of compact bone.

The long bones belong in general to the locomotive apparatus, where they form levers, moved by the muscles in various directions: they are all placed in the limbs, where they form a central column, moveable in various directions. They diminish in length, and increase in number, successively from above downwards; from the humerus and femur to the phalanges of the fingers and toes. Hence the upper part of the limbs is characterized by extent of motion, the lower by multiplicity and variety of movements.

The broad bones have not much to do with locomotion, except as they afford extensive surfaces for the attachment of muscles. They compose cavities, such as those of the cranium and pelvis, for which their form is well adapted. Several are united to form one cavity, and this circumstance adds to the solidity of the structure, as the effect of external force is lost in the joints. They are generally concave and convex on their two surfaces.

The short bones are found in parts which unite mobility and solidity, as the vertebral column, the carpus, and tarsus. They are always of inconsiderable size, and therefore are found in large number in the parts which they compose. These parts are strong, because external force is lost in the articulations: they are moveable, because the combinations of several small motions produce a considerable effect.

Of the first production of the bones, and their gradual development while the fœtus remains in utero, and of the nourishment and growth of bone in general, an account is given in the articles EMBRYO and BONE: in the latter of which, and in EXTREMITIES, there is a description of their external configurations, and of the disposition of the bony substance. The organization and properties of the system are considered under the article BONE. Under MEDULLARY *System* and CARTILAGE the accounts of these subjects will be found; and the periosteum is described under MEMBRANE.

The skeleton is divided into the head, trunk, and extremities or limbs. As almost all the bones are formed originally of more than one piece, which separate portions of osseous matter gradually come together, and are ultimately consolidated, the number of distinct pieces of bone belonging to the skeleton is different at different ages. The following is the number of bones, when the ossification is complete; that is, about the twentieth year.

I. In the HEAD, consisting of the *cranium*, and the FACE, the former is made up of

- 1 or 2 ossa frontis,
- 2 ossa parietalia,
- 1 os sphenobasilare, or spheno-occipitale,
- 2 ossa temporum,
- 2 mallei,
- 2 incudes,
- 2 stapedes,
- 1 os ethmoideum.

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The latter of

- 2 ossa maxillaria superiora,
- 2 ossa palatina,
- 2 ossa malarum, or zygomatica,
- 2 ossa nasi,
- 2 ossa lacrymalia,
- 2 ossa turbinata inferiora,
- 1 vomer,
- 1 maxilla inferior,
- 32 teeth.

The whole amount of bones of the head is 59 or 60. The five pieces of the os hyoides added to these, make 64 or 65.

II. The TRUNK, comprehending the spine, chest, and pelvis, consists of

- 7 cervical } vertebræ,
- 12 dorsal }
- 5 lumbar }
- 2 or 3 bones of the sternum,
- 24 ribs,
- 1 sacrum,
- 4 ossa coccygis,
- 2 ossa innominata.

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57 or 58

III. The EXTREMITIES.

The upper contain

- In the shoulders, { 2 clavicles,
- { 2 scapulæ.
- In the arms, 2 humeri.
- In the fore-arms, { 2 radii,
- { 2 ulnæ.
- In the wrists, { 2 ossa navicularia or scaphoidea,
- { 2 ossa lunaria,
- { 2 ossa cuneiformia,
- { 2 ossa pisiformia, or orbicularia,
- { 2 ossa trapezia, or multangula majora,
- { 2 ossa trapezoidea, or multangula mi-
- nora,
- { 2 ossa capitata,
- { 2 ossa unciformia, or hamata.
- In the metacarpi, 10 ossa metacarpi.
- In the fingers, { 10 first or metacarpal phalanges,
- { 8 middle or second phalanges,
- { 10 third or ungual phalanges,
- { 8 sesamoid bones.
-
- 72

The lower extremities contain,

- In the thighs, 2 femora.
- In the legs, { 2 tibiæ,
- { 2 patellæ,
- { 2 fibulæ.
- In the tarfi, { 2 astragali,
- { 2 calcanei, or ossa calcis,
- { 2 ossa navicularia,
- { 2 ossa cuneiformia magna,
- { 2 ————— parva,
- { 2 ————— media,
- { 2 ossa cuboidea.

—
22

- Brought over 22
- In the metatarfi, 10 ossa metatarfi.
- In the toes, { 10 first or metatarsal phalanges,
- { 8 middle or second phalanges,
- { 10 third or ungual phalanges,
- { 6 sesamoid bones.
-
- 66
-

The whole number of bones will be 259 or 261. There is frequently a small bone of the sesamoid kind in the tendon of the external head of the gastrocnemius: and a roundish bit in the hyo-thyroid ligament. If both these should exist, we must add four to the preceding number.

A complete dry natural skeleton of a male subject of the middle size, weighs from 150 to 200 ounces; that of a female, from 100 to 160 ounces.

Of the bones just enumerated, the frontal, spheno-occipital, vomer, lower jaw, vertebræ, sacrum, coccyx, sternum, and os linguale medium, are single (imparia), and, being placed on the middle line of the body, symmetrical; all the others are double, or in pairs (paria); each pair being composed of a right and left corresponding bone. Hence the structure of the whole skeleton is symmetrical; that is, if we imagine a perpendicular line to be drawn through the whole body, from before backwards, it will divide the skeleton into two corresponding halves, a right and left; the single bones having their right and left sides exactly alike.

This observation, however, of the symmetry of the skeleton, is not to be understood rigorously; since the right and left of the double bones, or the right and left sides of the single ones, are not accurately alike. The right or left bone, or the right or left side of a bone, may be longer or shorter, broader or narrower, &c. &c. than the other. The vomer is generally bent to one side; the internal surface of the skull seldom symmetrical. The last rib is often an inch longer on one side than on the other. The sternum is seldom symmetrical; and the cartilages of the ribs are not fixed to it exactly opposite to each other. The articulations of the ribs with the spine often differ considerably on the two sides. But the symmetry of the external form is not disturbed by these differences. If the right side of a vertebra is more elevated than the left, the corresponding part of the neighbouring bone, or of the intervertebral cartilage, is accommodated to the deviation; so that the perpendicular line of the spinal column is not impaired, &c. &c.

The single bones may be regarded as the media of union of the two lateral halves, which constitute the skeleton: they join together these two halves into one solid whole. In this respect there is a marked difference between the bones and the other organic instruments of locomotion, the muscles. The diaphragm is the only muscle placed on the median line, and its structure is not symmetrical: it belongs in great measure to the internal or organic life, and corresponds, in its want of symmetry, to the arrangements of the internal organs. The skeleton, being the basis or point of support of the muscles, as well as of all the other organs, constitutes an entire and firm fabric; an attribute which it derives from the single bones, which may be regarded as the key-stones of the building. The muscles, not contributing to the solidity of the animal structure, are not united into such a single and firm assemblage.

The mode in which the different pieces of the skeleton are joined to each other, is considered under the article JOINT; to which, and to that of MEMBRANE, *Synovial*, we refer for the details regarding the anatomical structure of these connections.

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The osteology of the head, including the teeth, is considered under CRANIUM; that of the vertebral column under SPINE; of the chest under LUNG; of the pelvis under HEAD; and of the limbs under EXTREMITIES. The os hyoides, or linguale, is described in the article DEGLUTITION. The joints are considered together with the bones which they unite; except that the articulation of the lower jaw is described under DEGLUTITION; and those of the occiput, first and second vertebræ, under HEAD.

The observation, which we have made of the bones in general, that they influence and determine the form of the soft parts, holds good more particularly of the whole skeleton. Its form, in all men, and in all stages of their life, corresponds so entirely to the configuration of their body, that an experienced eye would easily determine, from a tolerably preserved skeleton, not only the age and sex, but the growth and most striking characters of bodily formation of the individual to whom it had belonged. Hence it is not enough for an artist to know the muscles: he must begin with studying the skeleton. However numerous the differences of individual configuration in the human race, still retaining its general character and resemblance, accurate examination will shew us not fewer diversities in the structure, form, size, greater or less elegance, and even greater or less fineness and firmness in the grain of the bone, in human skeletons, which still preserve the general character. Besides these endless individual traits, distinguishing each skeleton from others, we find very striking differences according to age and sex.

With respect to the former of these circumstances, skeletons have been divided into perfect and imperfect; the latter not very well chosen term being applied to fœtuses, children, and subjects in whom the epiphyses are not yet consolidated with the bodies of the bones, or converted into true apophyses; although, in relation to the rest of the structure, the bones are then as perfect as in the adult. The younger the subject, the more cartilage does the skeleton contain. Reckoning from the twentieth year backwards, the younger the subject the larger is the head, compared to the trunk and limbs; (the head is about one-half of the body, in the second month of utero-gestation; one-fourth in the ninth month; one-fifth at the age of three years; and one-eighth when the growth is complete;) the smaller are the bones of the face, and the larger the organ of hearing, in comparison to the cranium; the larger are the fontanelles; the flatter is the lower part of the face; the larger the chest in relation to the pelvis; the shorter the limbs; the larger the clavicles; the smoother and flatter the broad bones, and the rounder the cylindrical bones. See Albert Durer on the proportions of the body, particularly at the end of the first book; and Sue sur les Proportions du Squelette de l'Homme examiné depuis l'âge le plus tendre, jusqu'à celui de 25, 60 ans, &c. in les Mémoires présentés, &c. p. 572.

The male and female skeleton differ, not only in the whole combination, or the general impression, from a comparative survey, but also in the form and properties of the individual parts. These differences, however, are not clearly perceptible until some years have elapsed after birth. The plates of the female skeleton in Cheselden and Sue are not to be compared to the accurate delineations of the male skeleton by Albinus. Soemmering has, however, supplied the deficiency in his beautiful "Tabula sceleti femineæ junctæ descriptione," folio. He enumerates the following as the characters of the female. "The female skeleton is smaller and slenderer in all parts than the male. The ratio of the head, including the teeth, to the rest of the bony structure, is greater than in the male: the numbers are as 1 to 6 in

the former, 1 to 8 or 10 in the latter. The circumference of the female skull is larger on the first view, in skeletons of the same height. The skull is larger in proportion to the face: its foramina, the palatine arch, and the whole cavity of the mouth, are smaller. The whole thorax is shorter; larger above, as far as the fourth rib, narrower below; more moveable, less conical; more convex in front; more distant from the pelvis, the interval between the last rib and the os innominatum being greater; less prominent anteriorly, so that when the trunk is supine, the symphysis pubis is the highest point in the female, the thorax in the male subject. Generally, the cartilages of the true ribs are longer in proportion to the bone. The vertebral canal is more capacious, and the lateral openings for the nerves are also larger. The spinous processes are less prominent; the sternum is shorter, ending at the plane of the fourth rib, while it reaches to the plane of the fifth in the male.

"The loins are longer, and the angle between the last lumbar vertebra and the sacrum, constituting the promontory, is more acute.

"All the diameters of the pelvis are greater; the cruræ and tuberosities of the ossa innominata further apart; the space between the ossa pubis wider, and the ligaments of the symphysis consequently broader, although shorter.

"The sacrum is turned more backwards, so that its apex and the coccyx do not project so much into the pelvis. The acetabula are farther apart, and hence the unsteady gait of the sex: they are, however, nearer to the front of the pelvis, so that, when in the progress of pregnancy the centre of gravity is thrown more forwards, its equilibrium is better preserved.

"The lower limbs form a more acute angle with the pelvis; the feet are smaller.

"The shoulders are more slanting, and the articulations nearer together; the upper limbs are shorter, and the fingers more pointed.

"Female bones are distinguished from the male by having fewer asperities, smaller spines and protuberances, shallower impressions, smaller articulations, and being on the whole smoother and more finely turned. The shaft or body of a cylindrical bone is more slender, in comparison to the articular ends; and hence the fact which was specified above, of the greater weight of the head in proportion to the rest of the skeleton.

"The bones are not so hard in the female: they have, on the whole, a something peculiar, a feminine character, which is not easily described. Their extremities remain longer cartilaginous.

"The frontal sinuses are smaller; the interval between them, or the glabella, less elevated; and the superciliary arches less prominent. All the bones of the face are more slender. The figure of the alveolar circle is more elliptical in both jaws; in man more circular. The teeth are smaller. The os hyoides more slender.

"In the vertebræ, the bodies are longer, and more hollowed at the sides; the transverse processes are directed more backwards, so that the channels on each side of the spinous processes are deeper. The spinous processes are sharper pointed, shorter, and more slanting.

"The ribs are more slender, and flatter; their margins are consequently sharper.

"That the cartilages of the upper ribs are more frequently ossified; that those of the middle ribs are broader; and those of the lower longer, which has been asserted by some anatomists, does not seem clearly made out.

"The first bone of the sternum is longer in comparison to the second. The latter is more than double the length of

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the former in the male skeleton; but in the female it is often not so much as double. It is also thicker, in comparison with the second bone, in the female. These differences are observable in the embryo.

“The lumbar vertebræ are longer and more slender; the sacrum broader and more excavated.

“The ossa coccygis are smaller, more moveable, and directed more forwards. Some have observed, that five of these bones are met with more frequently in the female than in the male.

“The ossa innominata are broader, flatter, and more expanded horizontally. The angle formed between the descending ramus of the pubes and the symphysis is more open. The angle between the ossa pubis is acute in the male, but of 80° to 90° in the female, where it approaches much more to the figure of an arch.

“The ischiatic tuberosities are larger and smoother. The space between the tuberosity and the acetabulum is smaller; the ischiatic notch more considerable; the foramen ovale larger; the notch for the tendon of the obturator externus less considerable.

“The clavicles are less strongly curved, so that the scapulæ are thrown backwards; the male clavicles are more arched, and the shoulders therefore brought more forwards. In the male skeleton, the clavicles are inclined a little downwards, so as to form an obtuse angle with the sternum; while they form nearly a right angle in the female.

“The female scapulæ are smaller, slenderer, flatter, and have acuter angles.

“In the female, the thigh-bones are bent more forwards; the neck forms a greater angle with the body; the internal condyle is larger, more prominent, and longer, in comparison with the external.”

There are differences in some parts of the skeleton in the various races of mankind; that is, certain characters by which they can be distinguished from each other. The head is the part in which the strongest distinctive marks are observable. We have described these very fully, and entered at length into a consideration of the way in which they are produced, in the articles CRANIUM and MAN.

The national differences in stature, in the size, length, and proportion of the limbs, &c. must be accompanied with corresponding variations in the bony fabric. But there are no peculiarities of form in the individual bones, no varieties in the configuration of processes, or articular heads and cavities, nor in their mutual adaptation. On this subject also we refer to the article MAN.

The individual diversities of size and form must be attended with differences in the skeleton. The bones are sometimes longer, sometimes thicker. The head may be comparatively large or small; the shoulders broad or contracted; the thorax flat or prominent; the vertebral column more or less curved; the loins thick or slender; the thighs or legs, the fingers and toes, longer or shorter, &c.

Food seems to have no influence on the skeleton.

External causes have certainly, in some instances, influenced particular parts in individuals; as the application of artificial pressure to the head of the newly born. (See CRANIUM.) The effect of analogous pressure in contracting the feet of the Chinese women, producing anchylosis of the articulations, and thus rendering these instruments of locomotion nearly useless, is well known. Similar effects are produced daily on the feet, in compliance with the prevalent notions of beauty in Europe, under our own eyes.

But a more destructive process is that of the tight-laced stays of European females, who choose to fancy that beauty consists in having the chest large above and narrow below,

although nature has reversed these proportions. The ribs are contracted; the inferior aperture of the chest narrowed; the liver, stomach, and other abdominal viscera, subjected to a severe and most injurious pressure by this barbarous practice of civilized people. We have seen the figure of the thorax quite altered by this practice; the lower ribs being pushed in on the liver, and having left deep indentations in that organ. See Sömmerring's German treatise on this subject: “Von der Schädlichkeit der Schnurbrüsten.”

The effect of artificial causes in modifying the form, has, however, been much exaggerated: the round shape of the skull in the Turks being ascribed to their turbans, &c. A change is only to be effected by considerable and continued pressure on the bones in their growing state. These alterations are merely individual; they do not affect the race; as the offspring are born with the ordinary formation and characters of the species. See MAN.

Description of the Plates in which the Anatomy of the Skeleton is represented.

ANATOMY. *Osteology.* Plate XVIII.—Front view of the skeleton.

THE HEAD.

1. Os frontis.
2. Right os parietale or bregmatis.
3. Squamous portion of the right os temporis.
4. Mastoid process.
5. Meatus auditorius externus.
6. Condylod process of the inferior maxilla.
7. Coronoid process
8. Angle
9. Symphysis
10. Right superior maxilla.
11. Right os malæ or jugale.
12. Left ditto.

THE TRUNK.

13. Seventh cervical vertebra.
14. First rib.
15. Eighth or first false rib.
16. First lumbar vertebra.
17. Sacrum.
18. Ileum.
19. Pubes.
20. Ischium.

UPPER EXTREMITIES.

21. Clavicle.
22. Scapula.
23. Acromion.
24. Coracoid process.
25. Humerus.
26. Greater tuberosity.
27. Smaller ditto.
28. Eminence for the radius.
29. Trochlea.
30. Internal condyle.
31. Radius.
32. Tubercle of the radius.
33. Ulna.
34. Coronoid process of the ulna.
35. Os naviculare, or scaphoides.
36. Os lunare.
37. Os cuneiforme, or triquetrum.
38. Os pisiforme.
39. Os trapezium, or multangulum majus.

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ANATOMY. *Osteology.* Plate XVI.—Back view of the skeleton.

- 40. Os trapezoides, or multangulum minus.
- 41. Os capitatum.
- 42. Os unciforme, or hamatum.
- 43. Metacarpal bone of the thumb.
- 44. _____ fore-finger.
- 45. _____ middle-finger.
- 46. _____ ring-finger.
- 47. _____ little-finger.
- 48. First phalanx } of the thumb.
- 49. Second phalanx }
- 50. Sesamoid bones.
- 51. First phalanx } of the fore-finger.
- 52. Second phalanx }
- 53. Third phalanx }
- 54. First phalanx } of the middle-finger.
- 55. Second phalanx }
- 56. Third phalanx }
- 57. First phalanx } of the ring-finger.
- 58. Second phalanx }
- 59. Third phalanx }
- 60. First phalanx } of the little-finger.
- 61. Second phalanx }
- 62. Third phalanx }

LOWER EXTREMITIES.

- 63. Thigh-bone.
- 64. Trochanter major.
- 65. Trochanter minor.
- 66. Internal condyle.
- 67. External condyle.
- 68. Patella.
- * Semilunar cartilage.
- 69. Tibia.
- 70. Internal condyle.
- 71. External condyle.
- 72. Tuberosity.
- 73. Internal malleolus.
- 74. Fibula.
- 75. Its head.
- 76. External malleolus.
- 77. Astragalus.
- 78. Os calcis.
- 79. Os naviculare.
- 80. Os cuneiforme primum.
- 81. _____ secundum.
- 82. _____ tertium.
- 83. Os cuboideum.
- 84. Metatarsal bone of the great toe.
- 85. _____ second toe.
- 86. _____ third toe.
- 87. _____ fourth toe.
- 88. _____ fifth toe.
- 89. First phalanx } of the great toe.
- 90. Second phalanx }
- 91. First phalanx } of the second toe.
- 92. Second phalanx }
- 93. Third phalanx }
- 94. First phalanx } of the third toe.
- 95. Second phalanx }
- 96. Third phalanx }
- 97. First phalanx } of the fourth toe.
- 98. Second phalanx }
- 99. Third phalanx }
- 100. First phalanx } of the fifth toe.
- 101. Second phalanx }
- 102. Third phalanx }

HEAD.

- 1. Os parietale, or bregmatis.
- 2. Foramen parietale.
- 3. Malar process of the os frontis.
- 4. Os malæ.
- 5. Zygoma.
- 6. Squamous portion of the temporal bone.
- 7. Mastoid foramen.
- 8. Mastoid process.
- 9. Styloid process.
- 10. Os occipitis.
- 11. Lower jaw.

TRUNK.

- 12. Seventh cervical vertebra.
- 13. Twelfth dorsal vertebra.
- 14. Fifth lumbar vertebra.
- 15. Sacrum.
- 16. Os coccygis.
- 17. Ileum.
- 18. Pubes.
- 19. Ischium.
- 20. Foramen ovale.
- 21. First rib.
- 22. Eighth or first false rib.
- 23. Twelfth rib.

UPPER EXTREMITIES.

- 24. Clavicle.
- 25. Scapula.
- 26. Spine of the scapula.
- 27. Acromion.
- 28. Humerus.
- 29. Greater tuberosity.
- 30. External condyle.
- 31. Internal condyle.
- 32. Radius.
- 33. Its head.
- 34. Ulna.
- 35. Olecranon.
- 36. Os naviculare.
- 37. Os lunare.
- 38. Os cuneiforme or triquetrum.
- 39. Os pisiforme.
- 40. Os multangulum majus.
- 41. Os multangulum minus.
- 42. Os capitatum.
- 43. Os hamatum or unciforme.
- 44. Metacarpal bone of the thumb.
- 45. _____ fore-finger.
- 46. _____ middle-finger.
- 47. _____ ring-finger.
- 48. _____ little-finger.
- 49. Sesamoid bone.
- 50. First phalanx } of the thumb.
- 51. Second phalanx }
- 52. First phalanx } of the fore-finger.
- 53. Second phalanx }
- 54. Third phalanx }
- 55. First phalanx } of the middle-finger.
- 56. Second phalanx }
- 57. Third phalanx }
- 58. First phalanx } of the ring-finger.
- 59. Second phalanx }
- 60. Third phalanx }

61. First phalanx }
 62. Second phalanx } of the little-finger.
 63. Third phalanx }

LOWER EXTREMITIES.

64. Thigh-bone.
 65. Its neck.
 66. Trochanter major.
 67. Trochanter minor.
 68. External condyle.
 69. Internal condyle.
 * Semilunar cartilage.
 70. Tibia.
 71. Its external condyle.
 72. Its internal condyle.
 73. Internal malleolus.
 74. Fibula.
 75. Its head.
 76. External malleolus.
 77. Astragalus.
 78. Os calcis.
 79. Os cuboideum.
 80. Os naviculare.
 81. Os cuneiforme primum.
 82. ————— secundum.
 83. ————— tertium.
 84. Metatarsal bone of the great toe.
 85. ————— second toe.
 86. ————— third toe.
 87. ————— fourth toe.
 88. ————— fifth toe.
 89. } Sefamoid bones.
 90. }
 91. First phalanx of the great toe.
 92. ————— second toe.
 93. ————— third toe.
 94. Second phalanx of the third toe.
 95. First phalanx of the fourth toe.
 96. Second phalanx of the fourth toe.
 97. Third phalanx of the fourth toe.
 98. First phalanx of the fifth toe.
 99. Second phalanx of the fifth toe.
 100. Third phalanx of the fifth toe.

For the anatomy of the skeleton, see Cheselden's *Osteographia*, or the Anatomy of the Bones, fol.; *Traité d'Osteologie*, traduit de l'Anglois de Mr. Monro, &c. par Mr. Sue, 2 vols. fol.; C. J. Trew, *Tabulæ Osteologiæ*, 1767, fol.; Albinus de *Ossibus Corporis Humani*, 1726, 8vo.; Albinus *Tabulæ Sceleti & Musculorum*, 1747, fol.; Albinus *Tabulæ Ossium*, 1763, fol.; Albinus *Icones Ossium Fœtus*, 1737, 4to.; Albinus *Annotationes Academicæ*, 4to.; Soemmering *Tabula Sceleti Feminei, junctâ Descriptione*, fol.; Soemmering *de Corporis Fabrica*, t. i.; J. G. Walter von trocken *Knochen*, 1763, 8vo.; J. F. Blumenbach, *Gefichte und Beschreibung der Knochen*, 1786, 8vo.; Bertin *Osteologie*, 4 tom. 8vo.; Boehmer *Institutiones Osteologiæ*, 8vo.

We have, in the *Philosophical Transactions*, an account of a human skeleton, all the bones of which were so united, as to make but one articulation from the back to the os sacrum, and downwards a little way. On sawing some of them, where they were unnaturally joined, they were found not to cohere throughout their whole substance, but only about a sixth of an inch deep all round. The figure of the trunk was crooked, the spine making the convex, and the inside of the vertebræ the concave part of the segment.

The whole had been found in a charnel-house, and was of the size of a full-grown person.

SKELETON, Vegetable. The preparations of leaves, fruits, roots, &c. called vegetable skeletons, are made in this manner. Choose for this purpose the leaves of trees or plants, which are somewhat substantial and tough, and have woody fibres, such as the leaves of orange, jasmine, bay, laurel, cherry, apricot, peach, plum, apple, pear, poplar, oak, and the like; but avoid such leaves as have none of the woody fibres, which are to be separated and preserved by this method; such are the leaves of the vine, lime-tree, and the like. The leaves are to be gathered in the months of June or July, and such to be chosen as are found and untouched by caterpillars, or other insects. These are to be put into an earthen or glass vessel, and a large quantity of rain-water to be poured over them; and after this they are to be left to the open air, and to the heat of the sun, without covering the vessel. When the water evaporates, so as to leave the leaves dry, more must be added in its place: the leaves will by this means putrefy, but they require a different time for this; some will be finished in a month, and others will require two months or longer, according to the hardness of the parenchyma of them. When they have been in a state of putrefaction some time, the two membranes will begin to separate, and the green part of the leaf to become fluid: then the operation of clearing is to be performed. The leaf is then to be put upon a flat white earthen plate, and covered with clear water; and being gently squeezed with the finger, the membranes will begin to open, and the green substance will come out at the edges; the membranes must be carefully taken off with a finger, and great caution must be used in separating them near the middle rib. When once there is an opening towards this separation, the whole membrane always follows easily: when both membranes are taken off, the skeleton is finished, and it is to be washed clean with water, and then preserved between the leaves of a book.

The fruits are divested of their pulp, and made into skeletons in a different manner. Take, for instance, a fine large pear that is soft, and not strong; let it be nicely pared without squeezing it, and without hurting either the crown or the stalk; then put it into a pot of rain-water, cover it, set it over the fire, and let it boil gently till it is perfectly soft, then take it out, and lay it in a dish, filled with cold water; then hold it by the stalk with one hand, and with the other hand rub off as much of the pulp as you can with the finger and thumb, beginning at the stalk, and rubbing it regularly towards the crown. The fibres are most tender toward the extremities, and therefore to be treated with great care there. When the pulp is thus cleared pretty well off, the point of a fine penknife may be of use to pick away the pulp sticking to the core. In order to see how the operation advances, the foul water must be thrown away from time to time, and clean poured on in its place. When the pulp is in this manner perfectly separated, the clean skeleton is to be preserved in spirit of wine.

Skeletons of roots which have woody fibres, such as turnips, and the like, must be made by boiling the root, without peeling it, till it be soft, that the pulp may be squeezed away by the fingers in the same manner, in a dish of water. Many kinds of roots are thus made into elegant skeletons, and the same method succeeds with the barks of several kinds of trees; which, when thus treated, afford extremely elegant views of their constituent fibres. *Philos. Trans.* N^o 416.

SKELIGS, The Three, in *Geography*, islands in the Atlantic ocean, about 7 miles W. of Bolus Head, county of Kerry,

Kerry, Ireland, one only of which, the Great Skelig, is inhabitable. On this there was formerly an abbey; but it was removed to Ballinaskeligs, as a more convenient situation. See BALLINASKELIGS.

SKELL, a river of England, which runs into the Ure, near Rippon, in Yorkshire.

SKELLENBERG, a mountain of Bavaria, near Donauwert, where the French and Bavarians were defeated by the duke of Marlborough and prince Lewis of Baden.

SKELLFLETE, a river of England, which runs into the Humber, 12 miles W. of Hull.

SKELLINGE, a town of Sweden, in the province of Halland; 20 miles S.S.E. of Konfsback.

SKEMLIK. See KEMLIK.

SKENEATELES, a handsome post-village of America, in the state of New York, in Marcellus, Onondaga county, at the outset of the lake of the same name; 163 miles N. of W. from Albany. It has 60 houses, a handsome Presbyterian church, several mills, &c. on Skeneateles creek; and it has a brisk trade.

SKENEATELES Lake, a lake about fifteen miles long, and from half a mile to a mile and a half wide, principally in Onondaga county; six miles at its north end being in the township of Marcellus. Its trout and salmon trout are very large. The outlet is at the north end near the village of the same name, and the creek runs north, through Marcellus and Camillus, about ten miles to Seneca river, affording many fine seats for mills. Skeneateles, in the dialect of the Onondaga Indians, signifies long; and hence the name of the lake.

SKENECTADY. See SCHENECTADY.

SKENEK. See SCHENCK.

SKENESBOROUGH, a town of America, in Washington county, in the state of New York, situated on Wood creek, on the south side of lake George; burned by the Americans in 1777, with their baggage and military stores, when they were retreating before the British army under general Burgoyne. See WHITEHALL.

SKEOTISVAY ISLE, one of the Hebrides, in the parish of Harris, and shire of Inverness. It is about a mile long, and till of late years was uninhabited.

SKEP, in *Agriculture*, a coarse round farm basket. It is also provincially used to signify a bee-hive.

SKEPLE, or SKUTTLE, a sort of flat broad basket for winnowing corn.

SKER POINT, in *Geography*, a cape on the coast of South Wales, in the Brittol Channel. N. lat. $51^{\circ} 27'$. W. long. $3^{\circ} 42'$.

SKERAT, a rock in the Caledonian sea, near the west coast of Skye. N. lat. $57^{\circ} 24'$. W. long. $6^{\circ} 40'$.

SKERENIZ, a town of Bohemia, in the circle of Chrudim; 5 miles N. of Hohemaut.

SKERGULE, a rocky island near the south-west coast of Mull. N. lat. $56^{\circ} 18'$. W. long. $6^{\circ} 21'$.

SKERIVORE ISLES, a cluster of small islands, belonging to the Hebrides, Scotland; situated about 40 miles westward from the point of Mull.

SKERN, a river of England, in the county of Durham, which runs into the Tees.

SKERPING, a town of Sweden, in Upland; 38 miles N. of Upsal.

SKERRIES, a considerable fishing-town on the east coast of Ireland, in the county of Dublin, near which are several seats and villas. Opposite to it are some rocks, called Skerries, from which much kelp is procured. There are other islands of the same name off the coast of the county of Antrim, near Portrush.

SKERRIES, *The, or The Skerry Isles*, a cluster of small islands, situated to the eastward of the Mainland of the Shetland isles, to which they belong. The principal of them, and the only ones uninhabited, are Bruray, Grunay, and Houfay, which united contain about a hundred inhabitants, who are chiefly employed in fishing. These islands afford good anchorage for small vessels; but the want of a light-house renders the navigation in their vicinity very dangerous, and has been the occasion of many melancholy shipwrecks. Carlisle's Topographical Dictionary of Scotland, 4to. 1813. Sinclair's Statistical Account of Scotland, vol. vi. 8vo. 1794.

SKERRIES, *Isle of*, a small island, included in the parish of Llan Fair yn Ghorwy, cwmwd of Tâl-y-bolion, canttraef of Cemmaes, (now called the hundred of Tâl-y-bolion,) and county of Anglesea, North Wales, is situated at the distance of a mile and a half from the Mainland, and affords pasturage for a few sheep. The fossil stone called *asbestos*, is found here in great abundance; and at one extremity of the island is an excellent light-house, which is highly serviceable to vessels navigating between Ireland and the ports of Chester and Liverpool. The Welsh call this island Ynys y Mael Rhoniaid, *i. e.* the Isle of Seals. Carlisle's Topographical Dictionary of Wales, 4to. 1811.

SKERSTA, a town of Sweden, in Smaland; 10 miles N.N.E. of Jonkioping.

SKESMO, a town of Norway, in the province of Christiania; 14 miles E.N.E. of Christiania.

SKETHYE, a river of North Wales, in the county of Merioneth, which runs into the Irish sea, 3 miles N.N.W. of Barmouth.

SKEUDITZ. See SCHKEUDITZ.

SKEVERI, a town of Hindoostan, in Vissapour; 10 miles S.W. of Raibaug.

SKEW, or SKILE, *Facets*, among *Jewellers*. See FACETS.

SKEWRING CHBESE, in *Agriculture*, the practice of thrusting strong iron-wire skewers into cheeses, in order to draw off and discharge the whey from them. The skewers for this use are mostly about eighteen or twenty inches in length. See DAIRYING.

SKEYL, provincially to lean on one side, or throw up, as in unloading a cart.

SKEYL-Beast, in *Rural Economy*, provincially the partition of cattle-stalls.

SKEYLD, provincially parti-coloured, as geese, ducks, &c.; or shelled.

SKIALFAND'EFIORD, in *Geography*, a river of Iceland, which receives the waters of a large and rapid river called the Skialfandefiot, and also a river called Laxaa, which flows from the lake Myoatn. Husavik, a commercial station, lies on this river, N.E. of Eyafjord. Here is no good fishing; but many seals are caught during winter. Eider-ducks are very abundant on the coast.

SKIATIC STAY, in *Rigging*, a contrivance for hoisting and lowering burdens out of or in ships, which clinches or makes fast with two half-hitches, and the ends stopt, round the heads of the main and fore-masts, with a tackle depending from it over the hatchway.

SKIATO, in *Geography*, one of the Grecian islands, nearest to the coast of Greece, separated from the island of Scopoli only by a channel of about two leagues, and from the main land by one not much wider. Anchorages, rather numerous and safe, are to be found along the east coast, and between the small islets which are on the same side. To this circumstance the advantages of this little island are nearly reduced.

SKIBBEREEN,

SKIBBEREEN, a post-town of the county of Cork, Ireland, formerly called Stapletown. It is situated on the south side of the river Ilen, which flows into Baltimore harbour. This river is navigable nearly from Skibbereen for lighters; yet the trade is chiefly carried on by land-carriage, because the general prevalence of westerly winds renders the communication by sea always uncertain, and often tedious. Skibbereen, says Mr. Townsend, without patronage or encouragement, has, from the mere circumstance of its situation, become populous, thriving, and wealthy. At its markets and fairs, besides the other usual articles of merchandize, very large quantities of coarse linens and yarn are exposed to sale. The town is, notwithstanding, ill built, with a number of wretched cabins, and very dirty. It is 160 miles S.W. from Dublin, and 38 W. by S. from Cork. Townsend's Statistical Survey.

SKJCIE, a town of European Turkey, in Moldavia; 40 miles W. of Jally.

SKID, in *Rural Economy*, a term applied to the chain by which the wheel of a waggon is fastened, so as to prevent its turning round, upon descending a steep hill. See **DRAG**.

SKID-Beams, in *Ship-Building*, are the beams in the waist, which connect the fore-castle with the quarter-deck.

SKIDS, *Boat*, square pieces of timber bolted one on each side, and projecting over the stern, with sheaves in their outer ends to hoist the boat up. Boat-skids over the quarters are fixed at the heel, and suspended by a lift at the head; the latter of iron lately in the navy.

SKIDS, *Whale*, are long square pieces of timber, projecting from the sides of Greenland ships, for the convenience of hoisting and canting the whale out of the water.

SKIDDAW, in *Geography*, a mountain of Cumberland, England, is remarkable as being classed among the greatest eminences of the island. It is also distinguished for its romantic and grand scenery, as well as for the lakes in its different hollows, and near its base. Maurice, in his poem of "Netherby," thus characterises this august mountain:

"There, tow'ring Skiddaw, wrapt in awful shade,
Monarch of mountains, rears his mighty head;
Dark'ning with frowns fair Keswick's beauteous vale,
He views beneath the gathering tempests fail,
Secure, nor heeds the rolling thunder's rage,
Though Schruffel, trembling, marks the dire preface."

According to the trigonometrical survey, by colonel Mudge and his assistants, it is stated that the highest point of Skiddaw is 3022 feet above the level of the sea. Seafell, in the same county, is 3166 feet in height. Like the generality of mountains in this part of the kingdom, Skiddaw consists of numerous inequalities; deep hollows, and bold crags; irregular fissures, and gentle slopes. Its surface also presents a variety of substances, colours, and forms. In some places are vast masses of bare rock; in other parts, a soft short grass presents itself; and in others are heath, furze, and brambles. Wildness and grandeur are the general features. Mrs. Radcliffe gives a very interesting description of different parts of this mountain, in her "Journey through Holland," &c. 2 vols. 8vo. 1795. Other accounts are given in the following works: Hutchinson's *Excursion to the Lakes*, 8vo. 1776; *Well's Guide to the Lakes*, 8vo. 1802; Gilpin's *Observations and Remarks chiefly to picturesque Beauty on the Mountains and Lakes of Cumberland and Westmoreland*, 2 vols. 8vo. 1786.

SKIERENDAL, a town of Norway, in the province of Aggerhuus; 20 miles N.W. of Chriftiania.

SKIERN, a river of Denmark, which runs into the sea, 12 miles S. of Ringkiobing.

SKIFF, a boat much used in the river Thames. It differs from a wherry by being shorter and broader in proportion, and having a transom aft.

SKIFFI, in *Geography*, a small island in the Grecian Archipelago. N. lat. 38° 44'. E. long. 24° 13'.

SKILJI, a town of Asiatic Turkey, in Natolia; 48 miles E.N.E. of Constantinople.

SKILLING, in *Rural Economy*, a term signifying an ile, or bay of a barn; also a slight addition to a cot tage.

SKILLINGE, in *Geography*, a town of Sweden, in the province of Blekingen; 4 miles W. of Carlscrona.

SKILLINGS, a river of America, in the district of Maine, which runs into the sea, 4 miles W. of New Bristol.

SKILSKIOER, a sea-port of Denmark, in the island of Zealand, in a bay which communicates with the Great Belt; 48 miles S.W. of Copenhagen. N. lat. 55° 16'. E. long. 11° 27'.

SKILUGRUND, a small island on the east side of the gulf of Bothnia. N. lat. 63° 55'. E. long. 20° 50'.

SKIM-COULTER, in *Agriculture*, a sort of coulter invented by Mr. Duckett, for paring off the surface of coarse grass or other lands, and placing it in the bottom of the furrow, so as to be fully covered and secured. It has been used in different districts with the greatest advantage and success. It is stated in the Agricultural Report of Hertfordshire, that Mr. Biggs, near St. Albans, finds it of excellent effect in clover lays, and also wherever any rubbish is on the land that wants burying, as well as in breaking up old faintoin lays. And it may be beneficially employed on many other occasions.

SKIM-Coulter Plough, that sort of plough which has a skim-coulter of some kind or other attached to it. See **PLOUGH**.

SKIM-Milk, in *Rural Economy*, that sort of milk which is left, after the cream has been taken away or skimmed off from the surface of it. This process is mostly performed by means of a slight thin skimming-dish, after the milk has been set by for some time in shallow vessels, either in its natural state, or when having undergone, in some cases, the operation of scalding. Where the latter practice is followed, though it might at first be reasonably supposed that all the oily unctuous matter of the milk would be brought to the surface, yet it is found by experience that that is not the case; but that, on the contrary, the scalded skimmed-milk is much richer, and better even for the purpose of suckling calves, as well as capable of making far better cheese than the raw skimmed-milk. In Devonshire, the scalded skim or skimmed-milk is estimated at the value of a penny farthing the quart, either for the use of cheese-making, or that of feeding hogs.

The skim-milk in the county of Essex, as well as in many others, especially those more towards the north, is converted to the purpose of keeping and fattening porkers, and that of being disposed of, at the rate of about three-pence or four-pence the gallon, to the lower classes of the people; or that of taking in pigs to keep, at the price of about from three shillings and sixpence to four shillings and sixpence the week. A hog has been known to be fattened, in the above named district, in this way, to the weight of sixty-six stone, without the offal, at eight pounds to the stone, skim-milk only being given for the purpose.

In other districts, the farmers rear and bring up their calves, and keep their own hogs, on this sort of milk, as
well

well as prepare cheese from it, finding these the most profitable applications of it.

The result of a number of trials has shewn, that in forming skim-milk, about ten ounces of butter is taken from twelve pints of milk, under the scalding practice. See DAIRYING.

SKIM-Milk Cheese, that sort of cheese which is made from skim or skimmed-milk. It is mostly a poor inferior sort of cheese, though much of it is made in different districts of the kingdom. It is, however, frequently a practice to take away the cream from only a certain portion of the milk that is intended for cheese, as that of the night meal, &c. In Devonshire, when cheese is to be made, much care is taken that the milk be not heated so far as to produce bubbles under the cream, which is first to be taken off from it, or when it is to be used with it.

SKIMMER, in *Ornithology*. See RYNCHOPS.

SKIMMIA, in *Botany*, a name adopted by Kämpfer from its Japanese vernacular appellation, *Mijanea Skimmi*.—Kämpf. Amœn. fasc. 5. 779. Thunb. Nov. Gen. 57. Fl. Japon. 4. Schreb. 81. Willd. Sp. Pl. v. 1. 671. Mart. Mill. Dict. v. 4. Jusl. 425.—Class and order, *Tetrاندria Monogynia*. Nat. Ord. *Plantæ incertæ sedis*; Jusl.

Gen. Ch. Cal. Perianth inferior, of one leaf, very small, permanent, cloven nearly to the base into four, ovate, acute segments. Cor. Petals four, ovate, concave, minute. Stam. Filaments four, very short; anthers Pist. Germen superior, roundish; style solitary; stigma Peric. Berry ovate, umbilicated, slightly furrowed, smooth, full of mealy pulp, and splitting imperfectly into four parts. Seeds four, nearly triangular or convex externally, oblong, white.

Obf. The Perianth is occasionally cloven into five segments.

Eff. Ch. Petals four, concave. Calyx four-cleft. Berry with four seeds.

1. *S. japonica*. Japanese Skimmia. Thunb. Japon. 6a. Kämpf. Ic. Select. t. 5.—Native of Japan, near Nagasaki, ripening its fruit in December. Stem shrubby, erect, smooth. Branches alternate, nearly square. Leaves at the summits of the branches, alternate, stalked, numerous, oblong, undulated, entire, slightly notched towards the tip, erect, about a finger's length, with a reflexed margin; green and rugose above; pale and dotted beneath. Footstalks convex beneath, flat above, thickish, short. Flowers white, on round, thickened stalks, in terminal panicles.

The foliage is evergreen, and has an aromatic flavour.

SKIMMING-DISH, in *Rural Economy*, that sort of light thin-edged dish, which is employed in skimming the cream off the surface of milk, in the practice of the dairy. Dishes of this kind are made either of hard wood or tin, being formed in a nice, thin, light manner, with fine sharp edges. See DAIRYING.

SKIMMING-Spade, in *Agriculture*, that sort of sharp-mouthed spade which is employed in skimming or paring off the grassy surface, or sward of land, which is intended to be burnt. See PARING and BURNING.

SKIN, in *Anatomy*, a large thick membrane, spread over the whole body, serving as the external organ of feeling, and as a covering and ornament of the parts underneath. See INTEGUMENTS.

SKIN, Diseases of the. See CUTANEOUS Diseases; where an outline of the classification of these maladies, devised by the late ingenious Dr. Willan, by whom the pathology of these neglected and undistinguished disorders has been greatly elucidated, will be found. For more particular information, consult the articles LEPROSY, LICHEN, PSORIASIS, POR-

RIGO, HERPES, &c. and Dr. Bateman's Pract. Synopsis of Cutaneous Diseases, according to the arrangement of Dr. Willan.

SKIN, in *Rural Economy*, the hide of an animal. The refuse and waste of it which are caused by the different manufactures, and which arise in the various purposes to which it is applied, are capable of forming very useful manures, when they are in any suitable quantity; such as the chips of the shoemaker, the dressings and trimmings of the currier, the clippings of the farrier, and the waste offal matters of the tan-yard as well as the glue manufactory.

It has been suggested by the writer of the work on "Agricultural Chemistry," that the gelatine which is contained in every kind of skin is in a state fitted for its gradual solution or decomposition; and that when buried in the soil, it lasts or continues for a considerable time, and constantly yields a supply of nutritious matter to the plants, which are placed within the neighbouring range of its action. All waste matters of this nature should therefore be carefully preserved for the purpose of being applied as manures.

SKIN, in *Commerce*, is particularly used for this membrane stripped off the animal, to be prepared by the tanner, skinner, currier, parchment-maker, &c. and converted into leather, &c.

The use of skins is very ancient; the first garments in the world having been made of them. The Danes and other northern nations have a long time dressed themselves in skins. Moroccos are made of the skins of a kind of goats. (See MOROCCO.) Parchment is usually made of sheep-skins; sometimes of goat-skins. (See PARCHMENT.) Velum is a kind of parchment made of the skin of an abortive calf, or at least of a sucking calf. (See VELUM.) The true shammy is made of the skin of an animal of the same name; though frequently it is counterfeited with common goats' and sheep-skins. See SHAMMY.

The Indians in Carolina and Virginia dress buck and doe-skin in this manner: the felt being taken off, they strain them, with lines or otherwise, much like the clothiers' racks, in order only to dry them. When the hunting time is over, the women dress the skins, by putting them in a pond or hole of water, to soak them well; then with an old knife, fixed in a cleft stick, they force off the hair whilst they remain wet. This done, they put them into a kettle, or earthen-pot, and a proportion of deer's brains, dried and preserved for this purpose, is put along with them; this vessel is set on the fire till they are more than blood-warm, which will make them lather and scour clean; after this, with small flicks, they wrest and twist each skin, as long as they find any wet to drop from them, letting them remain so wrested for some hours, and then they untwist and stretch each of them in a sort of rack, so that every part is extended, and as the skin dries, they take a dull hatchet, or some such instrument, and rub them well over to force all the water and grease out of them, till they become perfectly dry, and then their work is done.

In this manner one woman (for the men never employ themselves in this work) will dress eight or ten skins in a day, that is, begin and finish them. Phil. Transf. No. 194. See BUFF.

For the manner of preparing shagreen, see SHAGREEN.

SKINS, lacquering and gilding. See LACQUER.

SKINK. See SCINCUS.

SKINKER, a cup-bearer, or butler. See ARCH Butler.

SKINNER, STEPHEN, in *Biography*, an antiquary, was born about the year 1622, in or near London. He received his academical education at Christ-church college, Oxford, in the year 1638, but the civil war caused him to leave the university

verfity without taking a degree. He thence travelled on the continent, and ftudied at various univerfities. On his return to his native country, he went to Oxford, and took his degree in arts, and then fettled as a phyfician at Lincoln, where he died in 1667. He was a man of very extenfive erudition, but is chiefly known by his works in etymology, which, after his death, came into the hands of Mr. Thomas Henshaw, who digefted, corrected, and enlarged them, and publifhed them in 1671, with the title of “*Etymologicon Linguae Anglicanae* ;” a work that has always been confidered as of high authority among the learned, and is ftill regarded as a moft ufeul book of reference.

SKINNERA, in *Botany*, Forft. Gen. t. 29, was fo named in honour of Mr. Skinner, an Oxford gentleman, whom Forfter terms “a moft acute and clear-fighted botanift,” but we have met with no record of him elfewhere ; and the genus thus denominated is in no refpect different from **FUCHSIA** ; fee that article. By the fpecific name, *excorticata*, the author feems to have had a punning allufion in his mind.

SKINNERS, *Company of*. See **COMPANY**.

SKINNING, in *Ship-Building*, a term often ufed for planking the bottom.

SKINOSA, in *Geography*, a defart ifland, or rather rock, in the Grecian Archipelago, about 12 miles in circumference ; 5 miles S. from the ifland of Naxia. N. lat. 36° 55'. E. long. 25° 32'.

SKINSKATTEBERG, a town of Sweden, in Weftmanland ; 25 miles N.N.W. of Stroemfholm.

SKINTEL, a town of European Turkey, in Moldavia ; 10 miles S. of Jaffi.

SKINUS, *σκινος*, a name given by the ancient naturalifts to the lentil-tree, and alfo to a peculiar fpecies of the fquill, or feilla, which was not naufeous and emetic as the common fquill, but efulent and pleafant to the tafte.

SKIOLDS, in *Geography*, a town of Norway, in the province of Bergen ; 32 miles N. of Stavanger.

SKION, a town of Sweden, in Medelpadia, near the coaft of the gulf of Bothnia. The church was formerly a cattle, and the fteeple is full of loop-holes for arms ; 30 miles S. of Hernofand.

SKIPNESS POINT, a cape of Scotland, on the E. coaft of Kintyre, with a village called Skipnefs ; 22 miles N. of Cambletown. N. lat. 55° 49'. W. long. 5° 24'.

SKIPPACH CREEK, a creek of America, in the Delaware, where general Washington was encamped before the battle of German Town, in the county of Montgomery.

SKIPPACK, a townfhip of Pennsylvania ; 20 miles N. of Philadelphia. Shippack and Perkiomen contain 902 inhabitants.

SKIPPER. See **SHIPPER**.

SKIPPER, an Englifh name for the common gar-fifh. See **ACUS**.

SKIPPON, in *Geography*, a river of England, in the county of Lancafter, which runs into the Wyre.

SKIPSILAR, a town of European Turkey, in Romania ; 72 miles E. of Emboli.

SKIPTON, or *Skipton in Craven*, a market-town in the eaft divifion of the wapentake of Staincliffe and Ewcrofs, Weft Riding of the county of York, England, is fituated at the diftance of 48 miles W. by S. from the city of York, and 216 miles N.N.W. from London. This town, which previoufly was a poor place, has, fince the inclofure of Knareborough foreft, become the chief mart for the diftrict of Craven. The market-day is Saturday, weekly ; when there is always a large fupply of different forts of grain, which is thence difperfed throughout Craven, and the ma-

nufacturing country in the north-eaft part of Lancafhire. Brown, in his Agricultural Survey of the Weft Riding of the County, affirms that upwards of two hundred carts regularly attend this market. The fairs here are numerous, *viz.* on the firft Saturday after old Twelfth-day, the 13th of March, the Saturday before Palm-Sunday, the Tuefday in Eafter-week, and every other Tuefday till Whitfuntide, chiefly for lean cattle ; Saturday before Whitfun-eve, and Saturday before Trinity Sunday, old St. James, old Martinmas, befides fortnight fairs every other Tuefday throughout the year for fat cattle, fheep, &c.

Skipton ftands clofe to the Leeds and Liverpool canal, a circumftance which greatly facilitates its trade. It confifts chiefly of one very wide and long ftreet, where the markets are held, with feveral ftaggling lanes on each fide of it. The church, which is fituated at one extremity of the main ftreet, is a fpacious ftructure, with a tower at the weft end, which appears, from an infcription thereon, to have been rebuilt, in 1655, by the celebrated Ann Clifford, countefs of Dorfet, Pembroke, and Montgomery. Here are infcriptions, on plain ftones, in memory of the three firft earls of Cumberland.

Skipton caftle ftands at a fhort diftance to the eaftward of the church, and on the left fide of the road leading to Knareborough. This ancient ftructure is faid to have been originally erected foon after the Conqueft by Robert de Romeli, then lord of the honour of Skipton, whofe daughter and heirs carried it by marriage to William Fitz-Duncan, earl of Murray. From his family it paffed in the fame manner to William le Gros, earl of Albemarle, and afterwards fucceffively to William de Mandeville, earl of Effex, to Baldwin de Betun, and to William de Fortibus. In the reign of Richard I. Avelin, daughter to the fecond William de Fortibus, a minor, fucceeded, and became ward to king Henry III., who, in 1269, gave her in marriage to his fon Edmund, earl of Lancafter. On the forfeiture of her fon, earl Thomas, for rebellion againft king Edward II. the caftle was granted, in 1309, to Robert de Clifford, a Herefordfhire baron, whofe defcendants, earls of Cumberland, continued to enjoy it till the early part of the feventeenth century, when it devolved to Richard Sacville, earl of Dorfet, by his marriage with Ann Clifford, the diftinguifhed lady above-mentioned. By her daughter and heirs, Margaret, it was conveyed to John Tufton, fecond earl of Thanet, in whofe family it yet remains.

Skipton caftle, though apparently little calculated for defence againft the engines of modern warfare, appears to have been of confiderable importance during the civil wars between king Charles and his parliament. It was firft garrifoned in the royal caufe, and is faid to have held the furrrounding country for fome time in great awe. At length, however, it was vigorously befieged by a detachment of the parliamentary army, to whom it furrendered upon honourable terms on the 20th of December, 1645. In the following year, its works and defences were deftroyed by order of parliament. Lady Clifford, after the death of her fecond husband, the earl of Pembroke, repaired this caftle, in which fhe was born, and made it occasionally the place of her refidence. Though not much elevated above the furrrounding country, it nevertheless commands a pleafing view over the town and vale of Skipton, which is one of the fineft and moft fertile in England, extending about twelve miles in length, and from one and a half to two miles in breadth. It contains little tillage, but difplays the moft luxuriant meadows and paitures that can any where be feen.

Skipton, according to the parliamentary returns for 1811, contains 609 houfes, and 2868 inhabitants. The parifh is

of great extent, and is partly comprehended in Claro water-pentake. Beauties of England and Wales, vol. xvi. by John Bigland, 1812. Pennant's Tour in Scotland, 4to. 1790. Whitaker's History, &c. of Craven, 4to. 1805.

SKIPTON, a town of America, in Maryland, on the Potomack; 11 miles S.E. of Fort Cumberland.

SKIRINGLASS, a small island near the W. coast of Scotland. N. lat. 58° 2'. W. long. 5° 10'.

SKIRINTARSAN, a small island near the E. coast of Skye. N. lat. 57° 19'. W. long. 5° 33'.

SKIRKY, a cluster of small islands in Kenmare river, on the S.E. coast of Kerry; 5 miles E. of Lamb's Head.

SKIRMISH, in *War*, a disorderly kind of combat, or encounter, in presence of two armies, between small parties, or persons, who advance from the body for that purpose, and introduce to a general, regular fight.

The word seems formed from the French, *escarmouche*, which signifies the fame, and which Nicod derives from the Greek *χαρμν*, which signifies, at the same time, both *light*, *combat*, and *joy*. Menage derives it from the German, *schirmen* or *shermen*, to fence or defend: Du Cange, from *scarramuccia*, a light engagement, of *scara* and *muccia*, a body of soldiers hid in ambush; in regard many skirmishes are performed by persons in ambushade.

SKIRMISH Bay, in *Geography*, a bay on the E. coast of Chatham island, so called from an unhappy dispute between captain Vancouver's crew and the natives. S. lat. 43° 49'. E. long. 183° 25'.

SKIRO. See SCIRO.

SKIRRET, in *Botany*. See SRUM.

SKIRRID VAWR, or *Great Skirrid*, in *Geography*, a mountain of Wales, in the county of Monmouth; 2 miles N. of Abergavenny.

SKIRRIES, a rock in the North sea, near the E. coast of Scotland; 2 miles S. of Peterhead.

SKIRTING, in *Agriculture*, a mode of performing the business of sod-burning. See *SOD-BURNING*.

SKIT, in *Geography*, a town of Walachia, on the Ribnik; 80 miles N. of Bucharest.

SKITTIKISS, a bay on the E. side of Washington's islands, near the W. coast of North America.

SKITTISH, in the *Manege*. A horse is said to be skittish, in French *écouteux*, or *retenu*, that leaps instead of going forward; that does not set out, or part from the hand freely, nor employ himself as he ought to do.

SKIVE, in *Geography*, a town of Denmark, in North Jutland; 15 miles N.W. of Viborg. N. lat. 56° 34'. E. long. 9° 1'.

SKLENO, or *Glass Huts*, a town of Hungary, celebrated for its warm baths; 5 miles N. of Cremnitz.

SKOBELEKA, a town of Russia, in the government of Irkutsk; 48 miles S.S.W. of Kirensk.

SKODNY, a town of Silesia, in the principality of Oppereln, in which is a royal foundery for the casting of bombs; 10 miles S. of Oppereln.

SKOFDE, a town of Sweden, in West Gothland; 62 miles E. of Uddevalla.

SKOG, a town of Sweden, in the province of Helsingland; 34 miles W.N.W. of Hudwickswall.—Also, a town of Sweden, in Angermanland, on a lake; 20 miles N. of Hernofand.

SKOKHAM, *Isle of*, a small island situated in St. George's Channel, at the distance of five miles from St. Anne's Head, in Pembrokeshire, South Wales. It contains 200 acres, 2 roads and 2 poles of ground, and is the property of John Lloyd of Mabus, esq. Its products are barley,

oats, rye-grass, and rabbits. Fenton's Tour in Pembrokeshire, 4to. 1810.

SKOKI, a town of the duchy of Warfaw; 18 miles N. of Pofen.

SKOLEN, or SCHOLEN, a town of Saxony, in Thuringia; 8 miles S. of Naumburg.

SKOLOMISI, a town of Poland; 25 miles N.E. of Cracow.

SKOLOSCHIA, a town of Russia, in the government of Irkutsk; 44 miles N.E. of Kirensk.

SKOMAR, *Isle of*, a small island situated on the south side of St. Bride's bay, off the coast of Pembrokeshire, North Wales. It is divided from the Mainland by a narrow strait, called Jack's Sound. This isle contains 700 acres of land, a large portion of which is under cultivation, and is most prolific in rabbits, 2000 couple being killed annually for sale. It is the property of Charles Phillips, esq. of St. Bride's Hill. Fenton's Tour in Pembrokeshire, 4to. 1810. Carlisle's Topographical Dictionary of Wales, 4to. 1811.

SKOMPE, a town of the duchy of Warfaw; 16 miles N.E. of Wladislaw.

SKON, a town of Sweden, in the province of Medelpadia; 3 miles N. of Hernofand.

SKONE. See SCHONEN.

SKONGEN, a town of Norway, on the coast of Drontheim bay; 26 miles N.N.E. of Drontheim.

SKOPIA, or USKUP, a town of European Turkey, in Macedonia, on the river Varda, the see of an archbishop; 54 miles N. of Akrida. N. lat. 42° 40'. E. long. 21° 2'.

SKOPIN, a town of Russia, in the government of Riazan; 44 miles S. of Riazan. N. lat. 54°. E. long. 39° 14'.

SKORBY, a town of Sweden, in Schonen; 22 miles S.E. of Lund.

SKOTGRUND, a small island on the east side of the gulf of Bothnia. N. lat. 62° 17'. E. long. 21° 3'.—Also, a small island on the west side of the gulf of Bothnia. N. lat. 60° 39'. E. long. 17° 28'.

SKOTSCHAU, SCHOLSCH, or SKOZOW, a town of Silesia, in the principality of Teschen; 7 miles E.N.E. of Teschen. N. lat. 49° 47'. E. long. 18° 45'.

SKOVES, in *Agriculture*, provincially reaps, shoves, grips, or bundles of unbound up grain; also unbound sheaves of corn.

SKOUT, in *Ornithology*. See LOMWIA.

SKRABBA, in *Ichthyology*, a name given by some to a fish, called by Jonston and Schoneveldt the *scorpius marinus*, but wholly different from the *scorpana* of other authors. See FATHER-LASHER.

SKREED, in *Agriculture*, provincially a border or narrow slip of land.

SKREEN. See SCREEN.

SKREY, in *Geography*, a town of Bohemia, in the circle of Rakonitz; 8 miles S. of Rakonitz.

SKRUBBAN, a small island on the W. side of the gulf of Bothnia. N. lat. 63° 8'. E. long. 18° 34'.

SKRYNE, a small town of the county of Meath, Ireland, which received its name from being supposed to contain the shrine (*scrinium*) of St. Columba. There were a castle and two abbeys here, of which some ruins remain. Skryne is 19½ miles N. by W. from Dublin.

SKRZIWANE, a town of Bohemia, in the circle of Rakonitz; 4 miles S. of Rakonitz.

SKUA, in *Ornithology*. See CATARACTA.

This bird inhabits Norway, the Feroe isles, Shetland, and the noted rock Foula, a little west of them. It is also a native of the South sea. It is the most formidable gull; its prey being not only fish, but the lesser sorts of water-fowl,

fowl, as teal, &c. and it is also said to prey on ducks, poultry, and even young lambs; it has all the fierceness of the eagle in defending its young; when the inhabitants of the Ferro islands visit the nest, it attacks them with great force, so that they hold a knife erect over their heads, on which the skua will transfix itself in its fall on the invaders. In Foula it is a privileged bird, because it defends the flocks from the eagle, which it beats and pierces with great fury; and the natives impose a fine on any person who destroys one of these birds. Pennant.

SKUFE, in *Agriculture*, provincially a precipice or declivity.

SKULA, in *Geography*, a mountain of Sweden, in Angermanland; 10 miles N. of Hernofand.

SKULL, in *Anatomy*. See CRANIUM.

SKULL, *Injuries of the, &c.* See INJURIES of the Head.

SKULL-Cap, in *Botany*. See SCUTELLARIA.

SKULL-Cap, *Blue*, in *Agriculture*, the common name of a weed which is often found troublesome on wet boggy grounds, or near the sides of ponds. It is perennial in its growth, and of course more difficult in its removal from land. There is also a lesser sort, which has the same nature and habits of growth. They should both be eradicated from out of the land as much as possible.

SKUNK, in *Zoology*. See AMERICAN POLE-Cat.

SKUOE, in *Geography*. See SCUOE.

SKUOPING, a lake of North Carolina. N. lat. $35^{\circ}45'$. W. long. $76^{\circ}42'$.

SKUPPERNONG, a river of North Carolina, which communicates by means of a canal with the lake in Dismal Swamp.

SKURUP, a town of Sweden, in Schonen; 16 miles S.E. of Lund.

SKUSCH, a town of Bohemia, in the circle of Chrudim; 8 miles S.E. of Chrudim.

SKUTERAD, a town of Norway, in Aggerhuus; 22 miles W. of Christiania.

SKUTTOCK HILLS, five eminences in Hancock county, on the coast of Maine, that serve as landmarks for sailing into Gouldsborough harbour.

SKWERNIOW, a town of Bohemia, in the circle of Kaurzim; 6 miles S. of Kaurzim.

SKWORETZ, a town of Bohemia, in the circle of Kaurzim; 12 miles W.N.W. of Kaurzim.

SKY, the blue expanse of air or atmosphere.

The azure colour of the sky fir Isaac Newton attributes to vapours beginning to condense therein, which have got consistence enough to reflect the most reflexible rays, *viz.* the violent ones; but not enough to reflect any of the less reflexible ones.

M. de la Hire attributes it to our viewing a black object, *viz.* the dark space beyond the regions of the atmosphere, through a white or lucid one, *viz.* the air illumined by the sun; a mixture of black and white always appearing blue. But this account is not originally his; it is as old as Leonardo da Vinci. See BLUENESS and COLOUR of the Clouds.

SKY-Colour. To give this colour to glass, set in the furnace a pot of pure metal of frit from rochetta, or barilla, but the rochetta frit does best; as soon as the metal is well purified, take for a pot of twenty pounds of metal six ounces of brass calcined by itself; put it by degrees, at two or three times, into the metal, stirring and mixing it well every time, and diligently scumming the metal with a ladle; at the end of two hours the whole will be well mixed, and a proof may be taken; if the colour be found right, let the whole stand twenty-four hours longer in the furnace, and it will then be fit

to work, and will prove of a most beautiful sky-colour. Neri's Art of Glass, p. 40.

SKY-Flower, in *Botany*. See CINERARIA.

SKY-Rocket. See ROCKET.

SKYE, in *Geography*, one of the Hebrides, or Western islands of Scotland, is situated off the coast of Inverness and Ross-shires, from which it is separated by the found of Skye, and a branch of the sea called Lochalsh, while the Minch channel divides it from Long island. From the Point of Sleat in the south-east, to the Aird of Trotternish in the north-west, it extends 45 miles in length, but its breadth varies from 10 to 24 miles. The whole contents, measured carefully from Arrowsmith's map, are stated in the General Report of Scotland to amount to 535 square miles, including 336,000 acres of land, and 10 square miles of fresh-water lakes. From the numerous indentations of the sea, no part of the land is farther distant from salt-water than four miles and a half.

The general aspect of this island is extremely mountainous, so much so indeed, that not above twelve parts in a hundred of it are susceptible of arable cultivation; and even these are disposed in small patches or strips by the margin of the different bays, except at its north-westerly extremity, where, for four miles, the land is flat, the soil fertile and well cultivated, and the farms inclosed and divided. But notwithstanding this great proportion of mountain, Skye is far from being sterile or barren. On the contrary, its hills, so widely extended, and towering so proudly to the skies, are in general of considerable value, from the excellent pasture with which they abound. This is particularly the case in the central and southerly districts, where the hills of Cullin, resting on a bed of limestone, produce very rich herbage, on which are fed a remnant of the ancient herds of deer, for which this island was formerly famed, and which continue still to roam at large on these verdant heights. Most of the hills, in remote times, were clothed with wood; but except on the south coast of Sleat, scarcely any forest-timber now remains in Skye. Here, however, are still some good flocks of natural wood, consisting of oak, ash, elm, and birch, besides alder and willow.

The crops cultivated in this island are beans, oats, potatoes, and some flax. Artificial grasses and turnips are little known; but they are partially introduced, and it seems probable will soon become more extensive, as they are so very essential to the welfare of cattle, which are the staple commodity of the island. In the gardens and "kail yards," most of the esculent vegetables cultivated on the Mainland are raised with great success, as are also the smaller fruits.

The live-stock of Skye is estimated at 4000 horses, of a small but hardy race; 18,000 head of cattle of an excellent breed, of which about 3800 are exported annually, forming the principal export of the island. The sheep are computed at about 40,000 in number; but this computation is confessed by the reporter to the Board of Agriculture to be little more than conjecture. They consist partly of the native yellow-faced kind, partly of Cheviots, and partly of the black-faced Lintons, which are the most esteemed. Several thousands of this useful animal are exported every year. Hogs, goats, and rabbits abound here, but they are all of them so wild, and so little under controul, as to afford no permanent source of revenue. Game of all kinds is abundant, but is thought to decline more and more, in proportion as the country is progressively cultivated. There are on the island two kinds of serpents or vipers, both of which are reckoned very venomous.

In the surrounding seas, which embrace 750 miles of coast,

there are myriads of fish, particularly herring, mackarel, turbot, skate, ling, cod; and shell-fish, such as oysters, lobsters, &c.; so that combining the situation with other facilities, the inhabitants of Skye have an opportunity of enriching themselves by the fisheries, beyond any other islanders in Scotland, and in fact they apply themselves to them with considerable industry, and frequently with great effect. Sometimes, however, they are miserably tantalized with a profusion of fish, when they cannot procure an ounce of salt to cure them, owing to the distance from the custom-house, and to the complicated salt-duty regulations, which shut them up completely from either bettering their own circumstances, or promoting the general prosperity of the nation by this otherwise abundant bounty of providence.

Kelp is made annually to the extent of 500 tons; and the manufacture of this article is capable of being greatly increased, to the no small emolument of the natives, as well as to the increase of proprietors' rents.

The want of good roads has hitherto greatly retarded the internal prosperity of Skye, from the difficulty of conveyance, and this disadvantage does not admit of being easily removed; not merely from the inequality of the surface, but from the circumstance of its being so much cut up by brooks and rivulets, which, on every shower, swell into torrents that would require a great number of bridges.

The number of inhabitants in Skye, which, notwithstanding continued emigration, is still increasing, was 17,775 in 1809, the time when the last census was made; being at the rate of 33 to the square mile, reckoning the whole island, or 275 to the same extent, limiting the estimate to the cultivated land only. It has been for many ages, and still is, the property of the great clans, Macdonald, Macleod, and, till of late, Mackinnon. From the first of these has lately sprung up the kindred clan of Macalister. The people, ingenious, shrewd, and active, are nearly all of the established church of Scotland. Among them reside a number of gentlemen, who have been in the army or navy, cadets of the chief families, whose manners have given a polish to those of the inhabitants at large, which is observable in the behaviour even of the lowest peasant. In fact, every man in Skye seems to be a gentleman; whilst the demeanour of the females exhibits an ease and an affability that no person could expect in a country so remote, and having so little communication with strangers. Mr. Macdonald, in his Survey, justly observes, that "it is in truth a singular island, well deserving the attention of the geologist and natural historian, and capable, by nature, of one day astonishing the patriot and political economist."

The General Report, &c. of Scotland, drawn up under the directions of sir John Sinclair, bart. 8vo. 1814. Husbandry of Scotland, by sir John Sinclair, 8vo. 1815. Johnson's Journey to the Western Islands of Scotland, 8vo. 1775. Martin's Description of the Western Islands, 8vo. 1716. Account of the present State of the Hebrides, by James Anderson, L.L.D. 8vo. 1787. Macdonald's Survey of the Hebrides, 8vo. 1807.

SKYRO. See SCIRO.

SKYTTE, JOHN, in *Biography*, was born at Nyköping in 1577. After being some time secretary in the Swedish chancery, he was chosen by the states to be preceptor to prince Gustavus Adolphus, and at the same time by king Charles to superintend the education of John, duke of Oltrogothia, who was five years older than Gustavus. It was, therefore, considered as a master-piece of policy in the king, that he placed the crown-prince and the pretender to the throne under the inspection of so faithful and trusty an instructor. In 1622 he was made chancellor of the academy

of Upsal, and in 1629 governor-general of Ingria, Livonia, and Carelia. He was held in high estimation by the learned of his time, and acquired great celebrity on account of his eloquence, and was employed either as envoy or ambassador to many foreign courts. Gustavus Adolphus entertained for him the highest respect, and in 1624 the rank of baron was conferred on him. He was a great patron of literature, and rendered essential service to the academy of Upsal, by founding a professorship for the cultivation of the Latin language, literary criticism, and the political sciences. As a politician, he was a determined enemy of the aristocracy, and laboured with great zeal to establish royal authority. He died in 1645. Among his works was one, of which the following was the title; "Brief Instructions in regard to the Virtues and Arts which a Prince, who wishes to rule happily over his Kingdom and States, ought to exercise and employ; addressed to that exalted Lord and Prince Gustavus Adolphus."

SKYTTE, BENEDICT, son of the preceding, was born in 1614, and studied at Upsal. In 1629 he accompanied the Swedish ambassador, general Spence, to England, where, on taking his leave, he was knighted by king Charles I. After this he continued his studies at Dorpat, and travelled for his improvement, during which queen Christiana gave him a place in her household. He bore the marshal's staff at the diet in 1648, was appointed chancellor of the academy of Dorpat, and the year after was sent to Denmark, to be queen Christiana's proxy at the baptism of the princess Sophia Amelia, daughter of Frederic III. He enjoyed for several years the favour of his sovereign, and in 1651, when the queen established the order of the Amaranth, he was nominated one of the knights. Afterwards he fell into disgrace, and was brought to trial, but he made such an able defence that he was acquitted, and all the proceedings against him were annulled. He was restored to his seat as senator, and in 1665 was appointed governor of Esthonia. He was employed on an important mission from king Charles Gustavus to the duke of Courland, and he managed the business so well, that he received the approbation and cordial thanks of his sovereign. In 1663 he was made supreme judge in Ingria, president of the tribunal of Wismar, and at the same time envoy in Germany. But his good fortune again deserted him, he was dismissed from his offices at the diet held in 1664, and declared incapable of ever being employed either at home or abroad. After this he retired to his estate, and spent his time in literary pursuits till his death, in 1683. He was a man of great learning, and made himself known by various works, among which were the following: "Dissertatiuncula de Argumento quod Fœminæ Officium Legati mandari possit," 4to. "Oratio qua probatur Utilitatem pro Justitia, in Administratione Rerum publicarum colendam." Gen. Biog.

SLAA, in *Geography*. See SALLEE.

SLAB, an outside fappy plank or board sawed off from the sides of a timber-tree: the word is also used for a flat piece of marble.

SLABS of Tin, the lesser masses which the workers at the tin-mines call the metal into: these are run into moulds made of itone.

SLAB-Line, in *Sea Language*, a small cord passing up behind a ship's main-sail or fore-sail, and being reeved through a block attached to the lower part of the yard, is then transmitted in two branches to the foot of the sail to which it is fastened.

It is used to truss up the sail as occasion requires, and more particularly for the convenience of the pilot or steersman,

man, that they may look forward beneath it as the ship advances. Falconer.

SLABBERING-BIT, in the *Manege*. See **MASTIGADOUR**.

SLABETZ, in *Geography*, a town of Bohemia, in the circle of Rakonitz; 7 miles S. of Rakonitz.

SLABODA, a town of Poland, in the palatinate of Braclaw; 40 miles N.W. of Braclaw.

SLAB-TOWN, a village of America, in Burlington county, New Jersey, about half-way between Burlington and Mount Holly, and about four or five miles from each.

SLACK, in *Agriculture*, provincially a valley or small shallow dale or dip.

SLACK a Leg, in the *Manege*, called in French *mollir la jambe*, is said of a horse when he trips or stumbles.

SLACK the Hand, is to slack the bridle, or give a horse head.

SLACK-CLOTH, in *Sail-Making*, a certain quantity of cloth allowed to be gradually gathered up, in fewing on the bolt-rope to the sail, more than the length of the bolt-rope; otherwise the rope, by stretching in the wearing, might occasion the sail to split.

SLACKEN, in *Metallurgy*, a term used by the miners to express a spongy and femivitrified substance, which they use to mix with the ores of metals, to prevent their fusion. It is the scoria, or scum, separated from the surface of the former fusions of metals. To this they frequently add a lime-stone, and sometimes a kind of coarse iron-ore, in the running of the poorer gold-ores.

SLACK-WATER, in *Sea Language*, denotes the interval between the flux and reflux of the tide, or between the last of the ebb and the first of the flood, during which the current is interrupted, and the water apparently remains in a state of rest.

SLADE, in *Agriculture*, a term provincially signifying a sledge. See **SLEDGE**.

SLADE Down, a provincial term signifying to draw back part of the mould into the interfurrow with the plough dragging or sliding upon its side.

SLADE Point, in *Geography*, a cape on the N.E. coast of New Hoiland; 15 miles S.E. of Cape Hillsborough.

SLAG, in *Metallurgy*, &c. denotes vitrified cinder. See **SMELTING**.

Slag is found an useful material in repairing the roads in many places.

SLAGE, **SLAGEN**, or *Schlagen*, in *Geography*. See **SCHLAWA**.

SLAGELSE, a town of Denmark, in the island of Zealand; 42 miles W.S.W. of Copenhagen. N. lat. 55° 26'. E. long. 11° 29'.

SLAIGHTWAITE, a township and chapelry in the parish of Huddersfield, in Aylrig wapentake, and West Riding of the county of York, England, is four miles from the town of Huddersfield, and 190 from London. According to the population reports of 1811, this township contained 425 houses and 2277 inhabitants, the greater part of whom are engaged in the manufacture of cotton goods, which is the staple trade of this district.

SLAKE, in *Agriculture*, a term signifying the saturating of quick-lime with moisture, as water, &c.

SLAKED LIME, such as is reduced into a powdery state by the action of water upon it, or the hydrate of lime. In this case, the lime is combined with about one-third of its weight of water, that is, about 55 parts of the former absorb or drink up about 17 parts of the latter. See **LIME**.

SLAM, the refuse of alum-works, which is used as a manure with sea-weed and lime, in Yorkshire.

SLAMMERSDORP, in *Geography*, a town of the duchy of Holstein; 7 miles N.E. of Segeborg.

SLANDER, in *Law*. See **SCANDALUM Magnatum**.

SLANE, in *Geography*, a post-town of the county of Meath, Ireland, situated on the river Boyne. In the time of Hugh de Lacy this was a town of some note, being one of the boroughs in his palatinate of Meath. Here were many religious buildings, one of which was sometimes used as the residence of a royal prince, and was rebuilt by the lord of Slane in 1512. In the present remains of lord Slane's building, there are, according to Mr. Archdale, several fragments of the ancient abbey, and many of the architraves were evidently cut out of the ornamental parts, particularly one with the appearance of a head crowned. The castle that belonged to the lords of Slane, and was forfeited by them in 1641, is now the property of the Conyngham family. It has been much beautified, and is an elegant residence. At New Grange, near Slane, is a most remarkable mount, barrow, or rath, with a curious chamber in the centre, constructed of rude stones, and accessible only by a long passage, low, and very narrow. Governor Pownall has given a minute description of this barrow in the *Archæologia*, &c. It is also described in the "Collectanea de Rebus Hibernicis." Slane is 24 miles N. by W. from Dublin.

SLANETZ, a river of Russia, which runs into the Tobol; 60 miles S. of Tobolsk.

SLANEY, a river of Ireland, rising in the Wicklow mountains, near the source of the Liffey, and flowing in a southern direction through the counties of Wicklow, Carlow, and Wexford, to the harbour of Wexford. The towns of Stratford on Slaney, Baltinglase, Rathvilly, Tullow, Newtown Barry, Enniscorthy, and Wexford, are situated on it, and it receives the waters of the Derry, Bann, Urrie, and several smaller streams. It is navigable for small sloops to Enniscorthy.

SLANGE, NICHOLAS, in *Biography*, a Dutch historian of considerable celebrity, was born at Slagelse in the year 1657, of which place his father was the minister, and he was afterwards bishop of Viborg. Nicholas travelled at an early period, and in 1679 he paid a visit to Oxford, and in the year following he went to Cambridge. On his return he became, in 1681, secretary to the Danish chancery, and after going through various gradations of rank and office, he was ennobled in the year 1731. He died in 1737. He wrote "A History of Chrillian IV." which was published at Copenhagen in 1749, in two volumes, folio. It was afterwards translated into the German language. Gen. Biog.

SLANGER, in *Geography*. See **TUMB**.

SLANGERUP, a town of Denmark, in Zealand; 16 miles N.W. of Copenhagen. N. lat. 45° 51'. E. long. 12° 10'.

SLANT, in *Commerce*, a copper coin of Sweden. Here are single and double slants, at 1 and 2 ore silver, or 3 and 6 ore kopper; and rundtycken, of 1 ore kopper; and also half rundtycken: 96 double slants, 192 single slants, or 576 rundtycken, are 10 pafs for 1 specie rikfdaler: and this, commonly called the Swedish dollar, is worth 4s. 7½d. sterling.

SLAPANITZ, in *Geography*, a town of Moravia, in the circle of Brunn; 5 miles E.S.E. of Brunn.

SLAPDASH, in *Rural Economy*, provincially rough cast, or the liquid external coating of buildings.

SLAPER'S

SLAPER'S BAY, in *Geography*, a bay on the W. coast of Africa; 10 miles E. of Cape Blanco.

SLARADIA, a town of Asiatic Turkey, in Natolia; 28 miles N.N.W. of Eskir-Shehr.

SLASHER, in *Rural Economy*, a term sometimes applied to a plaster of hedges.

SLATCH, at *Sea*. When a rope or cable hangs slack, the seamen call the middle part, which hangs down, *the slatch of the cable*, or rope: so also, after long foul weather, if there come a small interval of fair, they say, *this is a slatch of fair weather*. But the term is generally applied to the period of a transitory breeze of wind.

SLATE, *Argillaceous Schistus* and *Argillite* of Kirwan; *Clay-slate*, *Jamelon*; *Thonfschiefer*, Werner; *Schiste Argilleux*, Fr.; in *Mineralogy* and *Geology*, one of the great rock-formations composing the crust of the globe, of which roof-slate is a well-known variety. The slaty or schistose structure is common to numerous rocks, which differ from each other, both in their geological position and constituent parts; hence we have a great variety of slate-rocks, amongst rocks which have been denominated primary, transition, and secondary. (See ROCKS.) The term slate appears to have a more appropriate meaning, when restricted to those rocks which, in their composition and structure, are most nearly allied to roof-slate or the clay-slate of Werner.

The most common colours of slate are a yellowish-grey, a greenish-grey, or a dark-blue or purple-grey: some varieties incline to a red, and others to a black-grey. Slate of the most perfect kind has a glistening lustre. It passes by gradation into mica-slate in the rocks called primary; and in rocks considered as secondary, it passes into slate-clay or shale.

The structure of slate-rocks *en masse* is tabular, the small structure laminar, the cleavage of the laminæ being parallel with the tables; hence slate has been represented by some geologists as most distinctly stratified; and the slaty cleavage is said to be always parallel with the strata; but this we believe to be a mistake, arising from confounding the divisions or joints of the tabular masses with the inclination of the beds. In the slate-quarries of Westmoreland and Cumberland, we have invariably observed the tables or divisions of the slate rise at a more elevated angle than the bed of which they form a part; and they are sometimes perpendicular, when the true dip of the bed is not more than forty degrees.

The slaty structure of the stone is the result of a process analogous to crystallization, by which the slate is divided into rhomboidal blocks or tables: between the bottom of one block and the top of another, there is frequently a seam of clay, which forms, what the workmen call, the foot of the slate. The slate will divide to this seam in a direction nearly at right angles with it; and sometimes between the upper and the lower block, there will be a thin horizontal stratum of slate occupying the place of the clay. This proves that the slate is not formed by mechanical stratification, and that the elevation of the tabular masses is unconnected with the elevation of the rock itself.

Slate-rocks vary in hardness, but they yield to the knife. They consist of an intimate intermixture, in various proportions, of siliceous earth, alumine, and iron; and sometimes contain a portion of lime, magnesia, manganese, and bitumen. Slate forms entire mountains, and mountain chains, and sometimes distinct beds, alternating with other rocks. It most frequently rests upon granite, gneiss, or mica-slate.

Slate-rocks are frequently intersected by veins of quartz,

and by metallic veins of lead, cobalt, and silver: it also contains beds of copper pyrites, red copper-ore, copper-green, malachite, iron pyrites, magnetic pyrites, glance cobalt, grey cobalt-ore, arsenical pyrites, blende and galena. The tin-veins in Cornwall sometimes pass through the killas, which is a variety of slate-rock.

Various rocks frequently occur imbedded in slate, particularly whet-slate, or hone, chlorite-slate, talcous-slate, drawing-slate, and alum-slate. Beds of flinty slate occur in this rock, and alternate with as well as graduate into it. Flinty slate appears to be slate in which a large proportion of siliceous earth is combined, until it approaches nearly to the nature of chert or flint. Organic remains are occasionally found in slate, on which account it is not considered by many geologists as a primary rock, if indeed there be any to which that term is appropriate. The slate which contains organic remains has been called by the Germans *the newer clay-slate*, and *transition-slate*; but remains of vegetables have been discovered in the slate of the Higher Alps in the vicinity of Mont Blanc, which may be supposed to have a better claim to the rank of primary than any other slate-rocks in Europe.

In a very large proportion of slate-rocks, the basis of the slate is intermixed with particles or fragments of other rocks; and when these are sufficiently large to be discerned without a lens, this kind of rock has received from the Germans the name of *grauwacke slate*. It is generally incumbent on the rocks denominated primary, and is supposed to be of more recent origin than the finer slate; but late observations have shewn that *grauwacke* is sometimes covered with granite and mica-slate. The killas of Cornwall appears, in many situations, to approach the nature of mica-slate, having a shining lustre, and a light grey colour, as if composed of an intimate intermixture of clay-slate with mica-slate. In Cornwall and Devonshire it occupies, in general, the same relative position with granite, in which mica-slate frequently occurs in other districts resting immediately upon it. The metallic veins which intersect these rocks are principally filled with ores of tin and copper, imbedded in a matrix of quartz; but it is observed, that the contents of the vein frequently vary as it passes through different rocks: if it contain tin-ore in the granite, it will change to copper-ores in the killas; and if tin be most abundant in the killas, the vein will change its contents as it passes into the granite. Veins of granite are also observed to shoot up into the killas, which is a proof that this kind of slate-rock is at least as ancient as the granite. This fact has given rise to some controversy among geologists, the disciples of Werner contending that the granite in the slate or killas was not in veins, but formed ridges or inequalities rising above the surface, which had been inclosed by subsequent depositions of the slate. For this explanation there can be no better reason given than its convenience in suiting a particular hypothesis respecting the formation of these rocks. Among other facts, which might be cited to prove that the granite veins penetrate the slate, there is one described in the "Annals of Philosophy," May 1814, which appears decisive. It occurs in Tonschole, in Cornwall. "The slate or killas is of a greyish dark colour, rather hard, but breaks into large fragments in the direction of the strata. The granite is of a fine grain, and the felspar is of a light flesh-colour, and contains but a small portion of mica. At the junction, numerous veins of granite may be traced from the rock of granite into the slate. Some of these veins may be observed upwards of fifty yards, till they are lost in the sea; and in point of size, vary from a foot and a half to less than an inch.

It may deserve notice, that as the felspar is of a flesh-red colour, it is impossible for any observer to consider them as quartz veins. One of these large veins is dislocated, and heaved several yards by a cross course. Another of these veins of granite, after proceeding vertically some distance, suddenly forms an angle, and continues in a direction nearly horizontal for several feet, with schistus, or slate, both above and below it. This appearance most completely destroys one of the theories suggested for the explanation of similar veins at St. Michael's Mount; *viz.* that a ridge of projecting granite had been left, and slate deposited afterwards on its sides." It is, indeed, quite impossible to conceive that a narrow vein of granite should shoot up into empty space for a considerable distance, and then assume a zig-zag direction, unsupported by any solid substance on the sides. The slate-rock must have existed when the vein was formed, and from its resistance have given it the form above described. Slate is one of the most abundant rocks in alpine districts, though that variety which splits into thin durable laminæ, forming good roof-slate, is far from being so common. The localities of common slate are so numerous in mountainous districts, that it were useless to point them out. Roof-slate, the *schiste ardoise* of the French, is found on the western side of our island in the counties of Cornwall and Devon, in various parts of North Wales and Anglesea, on the north-west parts of Yorkshire, near Ingleton, and in Swaledale, also in the counties of Cumberland and Westmoreland. It occurs in a low range of mountains at Chamwood forest, in Leicestershire, near the centre of England. Several geologists have stated that slate is found in Derbyshire, which is a mistake, as no rock similar to clay-slate or roof-slate occurs in that county. The inhabitants of that part of England make use of a micaceous sand-stone for roofing, which they denominate slate. This stone is found in strata among the other strata accompanying coal. Of the quality of the different kinds of English roof-slate, we shall offer some observations at the conclusion of this article. Slate abounds in various parts of Scotland, and in the county of Wicklow, and other mountainous parts of Ireland. France possesses many valuable beds of roof-slate, near Laferriere in Normandy, and in the neighbourhood of Angers. The last is the most important, as furnishing slate of the most perfect quality, and its extent and prodigious thickness make it regarded as inexhaustible. It is further remarkable on account of the very singular and interesting organic remains that occur between some of the laminæ of slate. It is, perhaps, one of the most valuable repositories of slate at present known.

This bed extends for a space of two leagues, passing under the town of Angers, which is built, as well as covered, with the slate; those blocks being employed in masonry which are the least divisible. The quarries which are actually explored, are all in the same line from west to east, as well as the ancient pits, the bed of the best roof-slate rising to the surface in this direction. Immediately under the vegetable earth is found a brittle kind of slate, which, for four or five feet deep, splits into rhomboidal fragments.

A little lower is what is called the building-stone, which is a firm slate, but scarcely divisible. This is employed in the construction of houses, after it has been sufficiently hardened by exposure to the air. At fourteen or fifteen feet from the surface is found the good slate, which has been quarried to the perpendicular depth of about three hundred feet; the remaining thickness being unknown.

As to the interior structure of this great mass of slate, it is divided by many veins or seams of calcareous spar and

quartz, about two feet thick, by fifteen or sixteen in height; these veins are parallel, and proceed regularly from west to east, in a position rising seventy degrees to the south; they are intersected by other veins at intervals of a similar kind, but whose rise is seventy degrees north; so that when they meet the former, they either form rhombs, or half rhombs, which have been compared to the letter V, some being upright, and others reversed.

All the layers, or laminæ, of the slate, have a direction similar to those of the veins of quartz, which rise south seventy degrees; and when intersected by veins that have an opposite inclination, the direction of the slaty laminæ is not changed. The whole mass is thus divided into immense rhomboids, composed of plates all parallel among themselves, and with two of the faces of the rhomboid.

The slate of Angers is extracted in blocks of a fixed size, which are divided into leaves for roofing-slate. It is betwixt these leaves that there are frequently found vestiges of marine animals, and particularly pyritous impressions of *pous de mer* (the sea-louse, a small univalve shell), also of small cheviettes (shrimps or prawns), and a species of crab, of which the body is about a foot in breadth, and fourteen or fifteen inches in length, the tail having nine or ten rings. The shrimps are sometimes so numerous, that forty have been counted on a slate of a foot square.

None of the above animals resemble any known existing species. But the most remarkable circumstance in these impressions, particularly in the large crabs, is, that though there be no sign of the body having been crushed, yet it can scarcely be said to have any thickness whatever. They rather resemble engravings than figures in relief, the convexity of these crabs above a thin leaf of slate not rising more than the fourth, and sometimes not more than the tenth part of a line; nor is it perceivable that the body of these crabs penetrates into the leaves of slate. What adds to the surprise, is the nearly vertical position in which these impressions are found in the mine.

A series of these leaves of slate may be compared to a set of books placed upon shelves; and the impressions of crabs, and other marine animals, to engraved plates in the volumes: they do not, in fact, occupy more thickness. It is equally difficult to conceive how the bodies of these animals, though perfectly defined, could be reduced to a simple surface, without thickness. These slates also present beautiful dendritical pyrites, more than a foot in extent. The pyrites are sometimes in small grains, disseminated, like dust, upon the surface of the slates, where may also be observed many little stars of selenite.

When the blocks of slate have been drawn from the quarry, if they are left exposed to the sun, or the open air, for some days, they lose what is called the *quarry-water*, and then become hard and untractable, and can only be employed as building stone. Frost produces a singular effect on these blocks: while frozen they may be broken with more ease than before; but if thawed rather quickly, they are no longer divisible: yet this quality may be restored by exposing them once more to the frost; but if the operation be often repeated, it becomes impossible to reduce them to leaves.

Some smaller beds of slate are worked on the northern elevities of the Pyrenées; but we have no account of any slate-quarries on the southern side, or in any part of Spain: yet it can scarcely be doubted that this rock exists in some of the mountainous parts of that kingdom.

Only one quarry of slate is said to be opened in Italy; it is at Lavagna, in the state of Genoa, and furnishes slate of an excellent quality, and so impervious, that it serves

erves to line the cisterns in which olive oil is preserved. The canton of Glaris, in Switzerland, is the only one in which roof-slate is procured. Roof-slate occurs in Saxony, and in various mountainous districts in the north of Europe; it is found also on the continent of North America; and as it is only a modification of clay-slate, which is an abundant rock, it is probable that its localities are much more numerous than are at present known in alpine districts in every part of the globe.

As this substance forms the most light, elegant, and durable covering for houses, and is, of course, of considerable value; it is rather surprising that so much indifference prevails respecting the search for it, in those districts where common slate, or *clay-slate*, abounds. We believe all the roof-slate quarries at present worked are those which accident has discovered. This neglect is the more remarkable, when we consider the great expence frequently incurred in searching for coal, a substance of much less value in proportion to the weight.

All the best beds of roof-slate with which we are acquainted, improve as they sink deeper into the earth; and few, if any, are of a good quality near the surface, or are indeed suitable for the purpose of roofing. There cannot be a doubt that many beds of slate, which appear shattered and unfit for architectural use, would be found of a good quality a few yards under the surface; for the best slate, in many quarries, loses its property of splitting into thin laminae by exposure to the air. Notwithstanding the value of slate, few quarries are worked to a very great depth, or have subterranean galleries, like mines. The quarry or slate-mine at Rimeuse, four leagues to the west of Charleville, on the Meuse, in France, is an exception. The mouth of the mine is near the summit of a hill: the bed inclines forty degrees to the horizon: it is about sixty feet in thickness, but its extent and depth are unknown. It has been pursued, by a principal gallery, to the depth of 400 feet; and they have driven many lateral galleries, which extend about 200 feet on the side of the main gallery, where 26 ladders are placed in succession, for the passage of the workmen and the carriage of the slate. In this bed, which is 60 feet in thickness, there are only forty feet of good slate, the other being mixed with quartz. They cut the slate into blocks of about 200 lbs., which they call *saix*: every workman, in his turn, carries them on his back to the very mouth of the pit, mounting the 26 ladders, or a part of them, according to the depth of the bed where he is working. When brought to day, these blocks are first split into thick tables, which are called *repartons*. The workman holds the block between his legs, puts a chissel on the side, and divides it with a blow of a mallet. The *repartons* are divided in a similar manner into roof-slates. These operations must be performed soon after the blocks are drawn from the quarry; for if the stone has time to dry, it would no longer be possible to split it. Some of the slate-galleries pass under the river Meuse.

There are few places in Great Britain where slate is worked as a mine under ground; most of the quarries are open to the day; and the covering of other rocks, or of coarse slate, which requires removing, greatly increases the expence. There is one slate-quarry worked as a mine by penetrating the interior of the mountain at Place-Fell, on the head of the lake of Ullswater, in Cumberland. Slate is also worked under ground on the western side of Yorkshire, adjoining Westmoreland. In many other situations it is probable that slate might be worked to advantage, in subterranean galleries, similar to those described in the quarries at Charleville; for as this mineral is generally of a better

quality at a considerable depth, the expence of procuring it by mining would be much less than that of removing the load of upper rocks, and working it in open quarries, as at present; at least the most valuable slate might be pursued to a far greater depth than is practicable in the common method in open quarries.

Slate, to be of a good quality for roofing, should have the property of splitting into thin even laminae: it should resist the absorption of water; to prove which, it should be kept some time immersed in water, being weighed before and after the immersion, wiping the surface dry; it is obvious, that the slate which gains the least weight by this process is the least absorbent. It should resist the process of natural decomposition by air and moisture: this depends on its chemical composition and compactness, and is shewn by its resisting the process of vegetation. That slate which is the most liable to decay, will be the soonest covered with lichens and mosses. The slate from Chamwood forest, in Leicestershire, resembles, in colour and appearance, the Westmoreland slate, but it will not split so thin, nor would this be desirable, for the vegetation which takes place upon it requires the roofs to be frequently scraped; this carries away a portion of the surface: a second growth of mosses produces a further wearing of the slate: hence a slate of a certain thickness from this part of England is not so durable as that from North Wales, Cornwall, or Westmoreland. This decay is probably owing to the greater quantity of alumine in its composition; it does not contain pyrites, nor have any organic remains been discovered in it.

Few slate-rocks have been accurately analysed; a reddish-purple slate from North Wales contained, according to Kirwan, .38 silice, .26 alumine, .8 magnesia, .4 lime, and .14 parts iron; but as there is in this analysis a loss of 10 per cent., it cannot be considered as very accurate. As the hardness of slate arises principally from the silice it contains, which is of all the earths the least favourable to vegetation, those slates which are the hardest when first taken from the quarry, and which have the least specific gravity, are to be preferred; for the increase of weight in slates is owing to the presence of iron, either in pyrites, or a slate of oxyd. To the presence of iron, many kinds of stone and slate also owe their tendency to decomposition. The pyrites being decomposed by moisture, and the iron admitting a still higher degree of oxygenation, the surface of the stone swells and peels off, or falls into an ochrey powder.

According to Dr. Watson, (bishop of Landaff,) the specific gravity of the Westmoreland slate varies in different quarries, from 2797 to 2732 ounces the cubic foot. The effect of frost is very sensible on tiled houses, but is scarcely felt on slated houses; for good slate imbibes very little water. According to an experiment made by Dr. Watson on Westmoreland slate, compared with tile, in which two pieces of each, about 30 inches square, were immersed in water 10 minutes, and then taken out and weighed as soon as they ceased to drop; the tile had imbibed about $\frac{1}{4}$ th of its weight of water, and the slate had not absorbed the $\frac{1}{20}$ th part of its weight: indeed the wetting of the slate was merely superficial. When placed before the fire, in a quarter of an hour the slate was of the same weight as it had been before it was put into the water; but the tile had only lost about 12 grains of its moisture, which was as near as could be expected to the quantity which had been spread over its surface; for it was the amount gained by the slate, the surface of which was equal to that of the tile. The tile was left to dry six days, in a room heated to sixty degrees, but did not lose all the water it had imbibed till the end of that time.

The slate in Westmoreland is blasted from the quarry in large

large masses, and split with proper tools by the workmen. Though the specific gravity of Westmoreland slate from different quarries is nearly the same, yet all the sorts are not capable of being split into an equal degree of thinness. Here also the quality varies with the depth of the quarry, that being the best which is raised from the greatest depth.

The grey-blue slate from Donyball, in Cornwall, weighs only 2512 ounces to the cubic foot, which is considerably lighter than that of Westmoreland. This slate is generally preferred to any other for its lightness, and enduring the weather; but Dr. Watson is of opinion, that in durability it does not excel that of Westmoreland. The Donyball slate is split into laminæ about one-eighth of an inch thick when it is applied to the covering of a roof; it then weighs rather more than 26 ounces to the square foot. The pale blue slate from Ambleside, in Westmoreland, weighs about two ounces more in the square foot than the former. In many instances, we believe slate of a thinner kind is used in several modern buildings to save the expence of timber in the roof, where cheapness rather than durability is a principal object with the architect. According to an estimate of Dr. Watson, the relative weights of a covering of the following different materials, for forty-two square yards of roof, are as under:

	Cwt.
Copper - - -	4
Fine slate - - -	26
Lead - - -	27
Coarse slate - - -	36
Tile - - -	54

A ton of fine slate will cover a larger surface than a ton of lead; and where there is water-carriage, does not cost one-fourth of the price. Slate might, therefore, be used generally instead of lead, with great advantage. Watson's Chemical Essays, vol. iv.

The most extensive slate-quarries in Great Britain are the property of lord Penryn, near Bangor, in Caernarvonshire. There is a rail-road formed from the quarries to the sea for the conveyance of the slate, which is of an excellent quality, and is sent to various parts of the world. The most remarkable situation where slate is procured in Cumberland, or perhaps in Great Britain, is Hourlton cragg, a lofty mountain near the lake of Buttermere, about 2000 feet above the level of the lake, and nearly perpendicular. On account of the difficulty of access, the workmen take their provisions for the week, and sleep in temporary huts on the summit. During the winter months they are generally involved in clouds, and not unfrequently blocked up by the snow. The slate is conveyed down a zigzag path cut in the rock on sledges, one man attending to prevent the acceleration of the descent. When the slate is emptied at the bottom, the sledge is carried back on his shoulders to the summit.

There are considerable slate-quarries near Ulverstone, in Lancashire. A coarse slate is got near Ingleton, in Yorkshire, and also in the vicinity of Settle in that county. The Ingleton slate frequently contains cubical pyrites, and is sometimes covered with dendritical pyrites.

Alum-slate, *ampellite* of Haiiy, is sometimes imbedded in clay-slate, but more frequently in stratified secondary rocks, and is not essentially different from some of the coal-shales. (See ALUM.) The alum-slate, or alum-shale of Whitby, is of vast and unknown thickness, forming the base of the Cleveland Hills in the North Riding of Yorkshire, extending about thirty miles east and west from Robinhood's bay,

to Gainsborough, Stokesly, and Osnotherly. On the south side of the Cleveland Hills the alum-slate is principally covered by sand-stone and marl. On the north-east, the alum-rock extends along the coast, about thirty miles from Robinhood's bay to Huntcliff. The height of the alum-cliffs, which are perpendicular from the sea, varies from 100 to 140 yards. Whitby abbey stands near an awful precipice of alum-slate or rock, which is undermined by every returning tide. At low water the alum-rock may be seen extending far to the east, forming a flat pavement, on which the observer may walk secure, treading at almost every step on the organic remains of the inhabitants of a former world, which are abundantly disseminated through the whole mass beneath, and projecting from the sides of the black and frowning cliffs above. The alum-slate has been perforated near the sea to the depth of 130 yards, without discovering the subjacent rock, to which we may add the height of the cliffs above, which will make a total thickness exceeding 220 yards. The upper parts of the bed are found more productive of alum than the lower. From the quantity of pyrites contained in this rock, it sometimes takes fire spontaneously, when a heap of it which has fallen from the cliffs becomes moistened with sea-water.

The animal remains are scattered through every part of the rock. They consist principally of numerous ammonites, nautilites, belemnites, fossil vertebræ (supposed to belong to the shark), with bivalve shells, fossil wood, and jet. Mr. Bakewell considers the alum-shale or slate, and the strata which cover it, as a peculiar local formation subjacent to the roe-stone, but above the coal-formation of Yorkshire or Durham. The alum-slate is in fact a thin bed of indurated pyritous slate-clay, differing little, except in geological position and its organic remains, from some of the coal-shales.

The alum-slate of Whitby has a very dark grey colour, a slaty structure, and rather a silky lustre; it splits, by exposure to the atmosphere, into very thin laminæ; it varies in hardness, but is all softer than roof-slate. The particular advantage which the country near Whitby possesses for the manufacture of alum, is derived from the alum-slate rising in precipitous cliffs, which afford facilities for working and burning the stone. Though many of the coal-shales might yield an equal quantity of alum, the difficulty of raising them to the surface would in most situations be too great to repay the expence. The alum-slate is piled in vast heaps and set fire to; a slow combustion is continued for several months, by the inflammable matter combined with the stone. The saline contents are extracted by solution, a small quantity of potash is added, and the alum is crystallized by evaporation. (Bakewell's Introduction to Geology.) From the alum-rock of Yorkshire, nearly all the alum of commerce in England is produced.

According to the analysis of Klaproth, alum-slate contains

Sulphur - - -	0.28
Carbon - - -	1.96
Alumine - - -	1.60
Silex - - -	4.00
Black oxyd of iron - - -	64
Sulphate of iron, lime, and potash, each - - -	15
Water - - -	70

M. Klaproth remarks, that the sulphur in the alum-slate which he analysed was not united to the iron but to the carbon, in a manner at present unknown. In the alum-slate of Whitby, we believe the sulphur is combined both with the iron and carbon.

Drawing-slate frequently accompanies alum-slate; it is much softer than common slate, and contains, like alum-slate, a considerable portion of carbon: its colour is a greyish-black: it is known by the property which it possesses of leaving a dark line when rubbed on paper. It is soft, and sometimes rather unctuous: some varieties have a small degree of lustre. The fracture, in small fragments, is scarcely slaty, and sometimes approaches the conchoidal. Drawing-slate is easily cut with the knife. Under the blowpipe it turns white or yellow. It sometimes effloresces like alum-slate. According to Wiegleb, it contains

Silex	-	-	-	64
Alumine	-	-	-	21.25
Carbon	-	-	-	11
Oxyd of iron	-	-	-	2.75
Water	-	-	-	7.50

Drawing-slate is employed by masons, carpenters, &c. to mark with. When fine and pure, it is used by artists for designs. In France it is called *Pierre d'Italie*, in England, *French chalk*. It is found in France, near Séer, in the department of l'Orne, and in the environs of Cherbourg. It is found also in Spain and Italy.

Whet-slate, or hone, the *novaculite* of Kirwan, occurs imbedded in clay-slate: its most common colour is greenish-grey, inclining to yellow: it is much harder than common slate: its texture is fine-grained, nearly compact, and the fracture of the small pieces splintery or conchoidal, resembling flinty slate. Its specific gravity is about 2.72. Whet-slate is translucent on the edges; it does not effervesce with acids, and it melts into a brown enamel under the blowpipe. From its green colour, and rather greasy feel, it may be considered as intermediate between hard talcous-slate and clay-slate. Though it yields to the point of a knife, or even of a copper tool, it acts upon the flattened or round surfaces of metals, and is used for sharpening and polishing the finer kinds of cutlery. It is of considerable value on account of this property, and was first brought from the Levant. We have no whet-slate of a fine quality in England. An inferior kind is procured from Chamwood forest, in Leicestershire. It exists of a finer quality in the promontory of Howth, near Dublin. The common whet-slate of commerce is procured from Saxony.

SLATE-Spar, *Schiefer-spath*, Werner, occurs in lime-stone beds, in mountains called primitive. Its colour is milk-white, or greenish and reddish-white, its lustre shining and pearly. Slate-spar is translucent and soft, its structure coarsely lamellar, passing into slaty, and sometimes curved or undulating: it is infusible, and effervesces with violence in acids.

SLATE, in *Rural Economy*, a well-known, neat, convenient, and durable material, for the covering of the roofs of buildings. There are great varieties of this substance; and it likewise differs very greatly in its qualities and colours. In some places it is found in thick laminæ, or flakes; while in others it is thin and light. The colours are white, brown, and blue.

It is so durable, in some cases, as to have been known to continue found and good for centuries. However, unless it should be brought from a quarry of well reputed goodness, it is necessary to try its properties, which may be done by striking the slate sharply against a large stone, and if it produce a complete sound, it is a mark of goodness; but if in hewing it does not shatter before the edge of the *set*, or instrument commonly used for that purpose, the criterion is decisive. The goodness of slate may be farther estimated by its colour: the deep black-blue is apt to imbibe moisture,

but the lighter blue is always the least penetrable: the touch also may be in some degree a guide, for a good firm stone feels somewhat hard and rough, whereas an open slate feels very smooth, and as it were greasy. And another method of trying the goodness of slate, is to place the slate-stone lengthwise, and perpendicularly in a tub of water, about half a foot deep, care being taken that the upper or unimmerged part of the slate be not accidentally wetted by the hand, or otherwise; let it remain in this state twenty-four hours; if good and firm stone, it will not draw water more than half an inch above the surface of the water, and that perhaps at the edges only, those parts having been a little loosened in the hewing; but a spongy defective stone will draw water to the very top. There is still another mode, held to be infallible. First, weigh two or three of the most suspected slates, noting the weight; then immerge them in a vessel of water twelve hours; take them out, and wipe them as clean as possible with a linen cloth; and if they weigh more than at first, it denotes that quality of slate which imbibes water: a drachm is allowable in a dozen pounds, and no more.

It may be noticed, that in laying of this material, a bushel and a half of lime, and three bushels of fresh-water sand, will be sufficient for a square of work; but if it be pin plastered, it will take above as much more: but good slate, well laid and plastered to the pin, will lie an hundred years; and on good timber a much longer time. It has been common to lay the slates dry, or on moss only, but they are much better when laid with plaster. When they are to be plastered to the pin, then about the first quantity of lime and sand will be sufficient for the purpose, when well mixed and blended together, by properly working them.

Slates differ very much in thickness as well as colour, which suits them for different situations and purposes. A great deal of good slate of various kinds is raised in different parts of Wales, and much excellent blue and other coloured sorts is procured from the northern parts of Lancashire, and other neighbouring places, as well as from different other counties throughout the kingdom. In some parts the slate is distributed into three kinds, as the best, the middling, and the waste or common sort. See QUARRY.

SLATE-*Axe*, provincially a mattock with a short axe-end, used in slating, &c.

SLATE *Mount*, in *Geography*, a mountain of Virginia; 6 miles W. of Richmond. N. lat. 37° 35'. W. long. 72°.

SLATE *River*, a river of Virginia, which runs into James river, N. lat. 37° 40'. E. long. 78° 34'.

SLATEE, an African appellation of free black merchants, often traders in slaves.

SLATERS, in *Entomology*. See MILLEPEDES and ONISCUS.

SLATERS and *Tilers*, are those artificers who are employed in slating or tiling houses. In calculating and estimating the value of their work, they find the content of a roof by multiplying the length of the ridge by the girt over from eaves to eaves; making allowance in this girt for the double row of slates at the bottom, or for the quantity or space by which one row of slates or tiles is laid over another. In angles formed in a roof, running from the ridge to the eaves, when the angle bends inwards, it is called a valley; but when outwards, it is called a hip. And in tiling and slating, it is common to add the length of the valley or hip to the content in feet. Deductions are seldom made for chimney-shafts, or small window-holes. *E. gr.* Required the content of a slated roof, the length being 45 feet 9 inches, and whole girt 34 feet 3 inches.

By Decimals.

45.75
34½

18300

13725

114375

9)1566.9375 feet.
174.104 yards.

By Duodecimals.

45 9
34 3

205 6

135

11 5 3

9)1566 11 3
174' 11" 3" Answer.

E. gr. What is the amount of the tiling of a house, at 25s. 6d. per square; the length being 43 feet 10 inches, and the breadth on the flat 27 feet 5 inches, and the eaves also projecting 16 inches on each side. Ans. 24l. 9s. 5½d.

SLATINA, in *Geography*, a town of Bohemia, in the circle of Schlan; 6 miles E. of Schlan.—Also, a town of Wallachia, on the E. side of the river Alaut; 2 miles N.E. of Brancovani.—Also, a town of European Turkey, in Moldavia; 18 miles N.W. of Niemez.

SLATTBOG, a town of Sweden, in the province of Smaland; 15 miles N.W. of Wexio.

SLATY ROCK, or *Schistus*, in *Agriculture*, a substance of a mouldering, enriching nature, which is sometimes blended up with other matters as a compost for land. The sort of material of this kind which forms the under-soil in many parts of Cornwall, and some other districts, is of an argillaceous, unctuous, soapy quality; which in some cases is ploughed up with a strong plough; and after being well exposed to the summer sun and winter frost, is mixed with lime or sand; in which state it is said to become a very capital thickener and fertilizer of thin poor worn-out soils, and by which much improvement is afforded at little trouble or expence.

SLAVANESS, in *Geography*, a cape on the E. coast of the island of Shetland. N. lat. 60° 31'. W. long. 1° 13'.

SLAVE, a person in the absolute power of a master, with regard to his life, liberty, and fortune. See SERVANT.

Menage and Vossius derive the word from *Sclavus*, the name of a Scythian people, whom Charlemagne condemned to perpetual imprisonment. See SCLAVONIC.

The Romans called their slaves, *servi*, from *servare*, to keep, or *save*; as being such as were not killed, but saved to yield money, either by sale, or by their work. Though other authors are of opinion, that the Roman name *servi* might come from that of *serbi*; as that of slaves from *Sclavi*, a people.

The term for a slave born and bred in the family, was *verna*; equivalent to *scurra*, denoting the petulance and impudence of these slaves. They seem to have been entitled by custom to privileges and indulgences beyond others.

Among the Romans, when a slave was set at liberty, he changed his name into a surname; he took the nomen or pre-nomen of his master, to which he added the cognomen he had been called by when a slave. See NAME.

Among those who were denominated slaves in the more lax and general use of the term, we may reckon those who were distinguished among the Romans by the appellation of "mercenarii," so called from the circumstance of their hire. These were free-born citizens, mentioned in the law-books by the name of *liberi*, and thus contradistinguished from the *alieni*, or foreigners, who, from the various contingencies of fortune, were under a necessity of recurring for support to the service of the rich. To this class belonged those who, both among the Jews and Egyptians, are recorded in the sacred

writings. (Gen. ch. xvii. Levit. xxv. 39, 40.) The Grecian *Thetes* (*Θητες*, see Hom. Odyll. Δ. 642.) were also of this description. The situation of these persons resembled that of our servants; a contract subsisting between the parties, and most of the subordinate dependants having a right to demand and obtain their discharge if they were ill used by their masters.

Among the ancients there was another class of servants, which consisted wholly of those who had suffered the loss of liberty from their own imprudence. Such were the Grecian *prodigals*, who were detained in the service of their creditors, till the fruits of their labour were equivalent to their debts; the *delinquents*, who were sentenced to the oar; and the German *enthusiasts*, mentioned by Tacitus, who were fo addicted to gaming, that when they had parted with every thing, also itated their liberty and their persons. "The loser," says the historian, "goes into a voluntary servitude; and though younger and stronger than the person with whom he played, patiently suffers himself to be bound and sold. Their perseverance in so bad a custom is styled *honour*. The slaves thus obtained are immediately exchanged away in commerce, that the winner may get rid of the scandal of his victory." The two classes now enumerated comprehend those that may be called *voluntary slaves*, and they are distinguished from those denominated *involuntary slaves*; who are forced, without any previous condition or choice, into a situation, which, as it tended to degrade a part of the human species, and to class it with the brutal, must have been, of all situations to which a human being can be reduced, the most wretched and insupportable.

We find no mention of slaves before the Deluge, but immediately after, *viz.* in the curse of Canaan, Gen. ix. 25; whence it is easily inferred, that servitude commenced soon after that time; for in Abraham's days we find it generally established. Some will have it to have commenced under Nimrod, because it was he who first began to make war, and of consequence to make captives; and to bring such as he took, either in his battles or irruptions, into slavery.

"Proud Nimrod first the bloody chace began,
Almighty hunter, and his prey was man." Pope.

Hence probably arose the connection between victory and servitude, an idea of which has prevailed among the nations of antiquity, and which has uniformly existed, in one country or another, to the present day. Accordingly, the first class of *involuntary slaves*, included those who were "prisoners of war;" and these were more ancient than the *voluntary slaves*, who are first mentioned in the time of Pharaoh. The practice of reducing prisoners of war to the condition of slaves, subsisted both among the eastern nations and the people of the West; for as the Helots became the slaves of the Spartans, merely from the right of conquest, so prisoners of war were reduced to the same situation by the other inhabitants of Greece. The Romans, also, were actuated by the same principle; and all those nations which contributed to overturn the empire, adopted a similar custom; so that it was a general maxim in their polity, that those who fell under their power as prisoners of war, should immediately be reduced to the condition of slaves. See PRISONERS of War.

The slaves of the Greeks were generally, or very commonly, barbarians, and imported from foreign countries.

By the civil law, the power of making slaves is esteemed a right of nations, and follows, *jure gentium*, as a natural consequence of captivity in war. "Jure gentium servi nostri sunt, qui ab hostibus capiuntur." Justinian, l. i. 5. 5. 1.

This is the first origin of the right of slavery assigned by

Justinian, Inst. i. 3, 4. whence slaves are called *mancipia quasi manu capti*.

The conqueror, say the civilians, had a right to the life of his captive; and having spared that, has a right to deal with him as he pleases. But this position, taken generally, is denied by judge Blackstone; who observes, that a man has a right to kill his enemy only in cases of absolute necessity, for self-defence: and, it is plain, this absolute necessity did not subsist, since the victor did not kill him, but made him prisoner. Since, therefore, the right of making slaves by captivity depends on a supposed right of slaughter, that foundation failing, the consequence drawn from it must fail likewise. Farther, it is said that slavery may begin "jure civili," when one man sells himself to another: but this, when applied to strict slavery, in the sense of the laws of old Rome or modern Barbary, is also impossible. Every sale implies a price, a *quid pro quo*, an equivalent given to the seller in lieu of what he transfers to the buyer; but what equivalent can be given for life and liberty, both of which, in absolute slavery, are held to be at the master's disposal? His property, also, the very price he seems to receive, devolves *ipso facto* to his master the instant he becomes his slave: and besides, if it be not lawful for a man to kill himself, because he robs his country of his person, for the same reason he is not allowed to barter his freedom: the freedom of every citizen constitutes a part of the public liberty. In this case, therefore, the buyer gives nothing, and the seller receives nothing; of what validity then can a sale be, which destroys the very principles upon which all sales are founded? Lastly, we are told, that besides these two ways by which slaves "sunt," or are acquired, they may also be hereditary, "*servi nascuntur*;" the children of acquired slaves are, *jure natura*, by a negative kind of birth-right, slaves also; but this being founded on the two former rights, must fall together with them. If neither captivity, nor the sale of one's self, can, by the law of nature and reason, reduce the parent to slavery, much less can they reduce the offspring. Blackst. Comm. b. i. c. 14. Montesquieu's Spirit of Laws, b. 15. c. 2, &c.

The Lacedæmonians, say some, or, as others say, the Assyrians, first introduced the practice; which the Romans not only approved of, but they even invented new manners of making slaves; for instance, a man born free among them might sell his freedom, and become a slave. This voluntary slavery was first introduced by a decree of the senate, in the time of the emperor Claudius, and at length was abrogated by Leo.

The Romans had power of life and death over their slaves, which no other nations had; but this severity was afterwards moderated by the laws of the emperors; and by one of Adrian it was made capital to kill a slave without a cause.

The slaves were esteemed the proper goods of their masters, and all they got belonged to them: but if the master were too cruel in his domestic corrections, he was obliged to sell his slave at a moderate price.

The custom of exposing old, useless, or sick slaves in an island of the Tyber, there to starve, seems to have been pretty common in Rome; and whoever recovered, after having been so exposed, had his liberty given him, by an edict of the emperor Claudius, in which it was likewise forbidden to kill any slave merely for old age or sickness. (Suet. in Claud.) Nevertheless, it was the professed maxim of the elder Cato, to sell his superannuated slaves for any price, rather than maintain what he deemed an useless burden. (Plut. in Caton.) The ergastula, or dungeons, where slaves in chains were forced to work, were very com-

mon all over Italy. Columella (l. i. c. 6.) advises that they be always built under ground; and recommends it as the duty of a careful overseer, to call over every day the names of these slaves, in order to know when any of them had deserted. Sicily was full of ergastula, and was cultivated by labourers in chains. Eunus and Athenio excited the fervile war, by breaking up these monstrous prisons, and giving liberty to 60,000 slaves.

In the ancient and uncivilized ages of the world, "piracy" was regarded as an honourable practice; and this was supposed to give a right of making slaves. "The Grecians," says Thucydides (l. i.) "in their primitive state, as well as the contemporary barbarians, who inhabited the sea-coasts and islands, addicted themselves wholly to it: it was, in short, their only profession and support." The writings of Homer are sufficient to establish this account; as they shew that this was a common practice at so early a period as that of the Trojan war. The reputation which piracy seems to have acquired among the ancients, was owing to the skill, strength, agility, and valour, which were necessary for conducting it with success; and the erroneous notions that were thus entertained concerning it led to other consequences, immediately connected with the slavery of the human species. Avarice and ambition availed themselves of these mistaken notions; and people were robbed, stolen, and even murdered, under the pretended idea that these were reputable adventures. But in proportion as men's sentiments and manners became more refined, the practice of piracy lost its reputation, and began gradually to disappear. The practice, however, was found to be lucrative; and it was continued, with a view to the emolument attending it, long after it ceased to be thought honourable, and when it was sinking into disgrace. The profits arising from the sale of slaves presented a temptation which avarice and interest could not resist; many were stolen by their own countrymen, and sold for slaves; and merchants traded on the different coasts in order to facilitate the disposal of this article of commerce. The merchants of Thessaly, if we may credit Aristophanes, (Plut. Act ii. Sc. 5.) who never spared the vices of the times, were particularly infamous for this latter kind of depredation; the Athenians were notorious for the former; for they had practised these robberies to such an alarming degree of danger to individuals, that it was found necessary to enact a law, which punished kidnappers with death. From the above statement it appears, that among the ancients there were two classes of involuntary slaves; one consisting of those who were taken publicly in a state of war; and another composed of those who were privately stolen in a state of peace. To which might be added a third class, comprehending the children and descendants of the former.

The condition of slaves, and their personal treatment, were sufficiently humiliating and grievous; and may well excite our pity and abhorrence. They were beaten, starved, tortured, and murdered at discretion; they were dead in a civil sense; they had neither name nor tribe; they were incapable of judicial process; and they were, in short, without appeal. To this cruel treatment, however, there were some exceptions. The Egyptian slave, though perhaps a greater drudge than any other, yet if he had time to reach the temple of Hercules (Herodotus, l. ii. 143.), found a certain retreat from the persecution of his master; and he derived additional comfort from the reflection that his life could not be taken with impunity. But no place was so favourable to slaves as Athens. Here they were allowed a greater liberty of speech; they had their convivial meetings, their amours, their hours of relaxation, pleasantries, and mirth; they were treated in such a manner as to warrant

rant the observation of Demosthenes, in his second Philippic, "that the condition of a slave at Athens was preferable to that of a free citizen in many other countries." And here, if persecution exceeded the bounds of lenity, they had their temple, like the Egyptian, for refuge; where the legislature was so attentive, as to examine their complaints, and to order them, if they were founded in justice, to be sold to another master. Besides, they were allowed an opportunity of working for themselves; and if their diligence had procured them a sum equivalent to their ransom, they could immediately, on paying it down, demand their freedom for ever. To this privilege Plautus alludes, in his "Casina," where he introduces a slave, speaking in the following manner:

"Quid tu me vero libertate territas?
Quod si tu nolis, filiusque etiam tuus
Vobis *invitis*, atque amborum *ingratis*,
Una libella liber possum fieri."

Thus we find, to the eternal honour of Egypt and Athens, that they were the only places, if we except the cities of the Jews, where slaves were considered with any humanity at all. The inhabitants of all other parts of the world seemed to vie with each other in the debasement and oppression of these unfortunate people.

The writer, of whose valuable publication we are now availing ourselves, and to whom the cause of humanity is under inexpressible obligations, proceeds to inquire by what circumstances the barbarous and inhuman treatment of slaves was produced?

The first of these circumstances, which he mentions, was "commerce;" for if men could be considered as "possessions;" if, like "cattle," they might be *bought* and *sold*, it will be natural to suppose, that they would be regarded and treated in the same manner. This kind of commerce, which began in the primitive ages of the world, depressed the human species in the general estimation; and they were tamed, like brutes, by the stings of hunger and the lash, and their education was so conducted, as to render them commodious instruments of labour for their possessors. This degradation of course depressed their minds, restricted the expansion of their faculties, stifled almost every effort of genius, and exhibited them to the world, as beings endued with inferior capacities to the rest of mankind. But for this opinion there seems to have been no foundation in truth or justice. Equal to their fellow-men in natural talents, and alike capable of improvement, any apparent or even real difference between them and some others must have been owing to the mode of their education, to the rank they were doomed to occupy, and to the treatment they were appointed to endure.

This commerce of the human species, which produced so pernicious an effect on the nature and state of man, commenced at a very early period. The history of Joseph, recorded in the book of Genesis, leads us to a very remote era for the introduction of this nefarious traffic. In his time it seems to have been prevalent, and to have been carried on in a manner, that sufficiently indicated its having been long before established. Egypt seems to have been at this time the principal, as it was probably the first, market for the sale of the human species. It was, indeed, so famous, as to have been known, within a few centuries from the time of Pharaoh, both to the Grecian colonies in Asia, and the Grecian islands. Homer mentions Cyprus and Egypt as the common markets for slaves, about the time of the Trojan war. (*Odyl. l. xvii. 448. l. xxvi.*) Egypt is also represented, as we have already intimated, in the book

of Genesis, as a market for slaves, and in Exodus (ch. i.) as famous for the severity of its servitude. Homer also, in the place above cited, points out to us Egypt as a market for the human species, and by the epithet of "*bitter Egypt*," alludes in the strongest manner to that severity and rigour, of which the sacred historian transmitted to us the first account. The *Odyssey* of Homer shews farther, that this species of traffic was practised in many of the islands of the *Ægean* sea; and the *Iliad* informs us, that it had taken place among those Grecians on the continent of Europe, who had embarked from thence on the Trojan expedition. To this purpose, at the end of the seventh book, a fleet is described, as having just arrived from Lemnos, with a supply of wine for the Grecian camp. The merchants are described also, as immediately exposing it to sale, and as receiving in exchange, among other articles of barter, "a number of slaves." Tyre and Sidon, as we learn from the book of Joel, ch. iii. 3, 4, 6, were notorious for the prosecution of this trade. This custom appears also to have existed among other states; it travelled all over Asia; it spread through the Grecian and Roman world; it was in use among the barbarous nations, which overturned the Roman empire; and was therefore practised, at the same period, throughout the whole of Europe. However, as the northern nations were settled in their conquests, the slavery and commerce of the human species began to decline, and on their full establishment they were abolished. Some writers have ascribed their decline and abolition to the prevalence of the feudal system; whilst others, much more numerous, and with greater strength of argument, have maintained, that they were the natural effects of Christianity. The advocates of the former opinion allege, that "the multitude of little states, which sprung up from one great one at this era, occasioned infinite bickerings and matter for contention. There was not a state or seignory, which did not want all the hands they could muster, either to defend their own right, or to dispute that of their neighbours. Thus every man was taken into the service: whom they armed they must trust: and there could be no trust but in free men. Thus the barrier between the two natures was thrown down, and slavery was no more heard of in the west."

That this was not the necessary consequence of such a situation, is apparent. The political state of Greece, in its early history, was the same as that of Europe, when divided by the feudal system into an infinite number of small and independent kingdoms. There was the same matter, therefore, for contention, and the same call for all the hands that could be mustered: the Grecians, in short, in the heroic, were in the same situation, in these respects, as the feudal barons in the Gothic times.

It must be allowed, on the slightest consideration of the subject, that Christianity was admirably adapted to this purpose. It taught, "that all men were originally equal; that the Deity was no respecter of persons; and that, as all men were to give an account of their actions hereafter, it was necessary that they should be free." These doctrines could not fail of having their proper influence on those who first embraced Christianity, from a conviction of its truth; and on those of their descendants afterwards, who, by engaging in the crusades, and hazarding their lives and fortunes there, shewed at least an attachment to that religion. We find them accordingly actuated by these principles. We have a positive proof, that the feudal system had no share in the honour of suppressing slavery, but that Christianity was the only cause; for the greatest part of the charters, which were granted for the freedom of slaves

in those times (many of which are still extant), were granted "pro amore Dei, pro mercede animæ." They were founded, in short, on religious considerations, "that they might procure the favour of the Deity, which they conceived themselves to have forfeited, by the subjugation of those, whom they found to be the objects of the divine benevolence and attention equally with themselves."

These considerations, which had thus their first origin in Christianity, began to produce their effects, as the different nations were converted; and procured that general liberty at last, which, at the close of the twelfth century, was conspicuous in the west of Europe.

Within two centuries after the suppression of slavery in Europe, the Portuguese, in imitation of those piracies which existed in the uncivilized ages of the world, made their descents on Africa, and committing depredations on the coast, first carried the wretched inhabitants into slavery. This practice, thus inconsiderable at its commencement, became general; and our own ancestors, together with the Spaniards, French, and most of the maritime powers of Europe, soon followed the piratical example: and thus did the Europeans, to their eternal infamy, revive a custom, which their own ancestors had so lately exploded, from a consciousness of its impiety. The unfortunate Africans fled from the coast, and sought, in the interior part of the country, a retreat from the persecution of their invaders; but the Europeans still pursued them; they entered their rivers, sailed up into the heart of the country, surprised the Africans in their recesses, and carried them into slavery. The next step, which the Europeans found it necessary to take, was that of settling in the country; of securing themselves by fortified posts; of changing their system of force into that of pretended liberality; and of opening, by every species of bribery and corruption, a communication with the natives. Accordingly they erected their forts and factories; landed their merchandize; and endeavoured, by a peaceable deportment, by presents, and by every appearance of munificence, to allure the attachment and confidence of the Africans.

The Portuguese erected their first fort at D'Elmina, in the year 1481, about 40 years after Alonzo Gonzales had pointed out to his countrymen the southern Africans as articles of commerce.

The scheme succeeded: an intercourse took place between the Europeans and Africans, attended with a confidence highly favourable to the views of ambition and avarice. In order to render this intercourse permanent as well as lucrative, the Europeans having discovered the chiefs of the American tribes, paid their court to these; and at length a treaty of peace and commerce was concluded; in which it was agreed, that the kings, on their part, should, from this period, sentence *prisoners of war* and *convicts* to European servitude; and that the Europeans should supply them, in return, with the luxuries of the north. This agreement immediately took place, and laid the foundation of that commerce, of which the following articles contain a brief history.

Slavery is absolutely abolished in England and France as to personal servitude; our servants are not slaves, but only are subject to certain determinate services. It is said, that the moment a slave steps on English ground, he by law becomes free. See NEGRO.

When an attempt was made to introduce slavery within this nation, by stat. 1 Edw. VI. c. 3. which ordained, that all idle vagabonds should be made slaves, and fed upon bread, water or small drink, and refuse of meat; should wear a ring of iron round their necks, arms, or legs; and

should be compelled, by beating, chaining, or otherwise, to perform the work assigned them, were it ever so vile; the spirit of the nation could not brook this condition, even in the most abandoned rogues; and, therefore, this statute was repealed in two years afterwards. 3 & 4 Edw. VI. c. 16.

For the custom of marking or stigmatizing slaves, see STIGMATIZING.

SLAVE-TRADE. At the close of the preceding article we have stated the manner in which this species of commerce commenced; nor is it necessary to mention one ostensible reason that was alleged for introducing the Africans, in particular, as labourers into the newly discovered parts of the western world, and placing them under European masters, *viz. the duty of converting the heathen*; because this was but an idle pretence. It was soon found that a usage, different from that which Christianity would have dictated, was necessary, where people were transported, and made to labour against their will. A system, therefore, of severity sprung up, as it related to their treatment, which became by degrees still more cruel and degrading; so that when in after-times the situation of master and slave came to be viewed, as it existed in practice between the two, the masters seemed to have attained the rank of monarchs, and the slaves to have gone down to the condition of brutes. Hence, very early after the commencement of the slave-trade, the objects of it began to be considered as an inferior species, and even their very colour as a mark of it; and under this latter notion they continued to be transported for years and years, till different persons, taking an interest in their sufferings, produced such an union of public sentiment in their favour in England, that the parliament there were obliged, as it were, to consider their case, by hearing evidence upon it. It is from this evidence, as from the highest authority, which was heard in the years 1791 and 1792, that we shall chiefly give our account of the trade in question.

The treaty to which we have referred, stipulated to supply the Europeans with captives and convicts; but these were not sufficient for their demand, on the establishment of their western colonies. In order, therefore, to augment the number, not only those who were fairly convicted of offences were now sentenced to servitude, but even those who were suspected; and with regard to prisoners of war, they delivered into slavery not only those who were taken in a state of public enmity and injustice, but those also who, conscious of no injury whatever, were taken in the arbitrary skirmishes of the venal sovereigns of Africa. Wars were made, not as formerly, from motives of retaliation and defence, but for the sake of obtaining prisoners alone, and the advantages resulting from the sale of them. When an European ship came in sight, this was considered as a motive for war, and a signal for the commencement of hostilities. The despotic sovereigns of Africa, influenced by the venal motives of European traffic, first made war upon the neighbouring tribes, in the violation of every principle of justice; and if they did not thus succeed in their main object, they turned their arms against their own subjects. The first villages at which they arrived were immediately surrounded, and afterwards set on fire; and the wretched inhabitants seized, as they were escaping from the flames. These, consisting of whole families, fathers, brothers, husbands, wives, and children, were instantly driven in chains to the merchants, and consigned to slavery. Many other persons were kidnapped, in order to glut the avarice of their own countrymen, who lay in wait for them; and they were afterwards sold to the European merchants: while

SLAVE-TRADE.

while the seamen of the different ships, by every possible artifice, enticed others on board, and transported them to the regions of servitude.

The collectors of slaves were distributed into several classes. The first consisted of such black traders as preserved a regular chain of traffic, and a regular communication with each other, from the interior parts of the country to the sea-shore. Many of the slaves, thus driven down, are reported to have travelled at least 1200 miles from the place where they were first purchased. A pistol or a sword may have been the full value of one of these slaves, at the first cost; but his price advances, as he travels towards the sea-shore. The second class of slave-traders is composed of such as travel inland, but have no chain of commerce or communication with the shore. At a certain distance they strike off in a line parallel to the shore, and visiting the fairs and villages in their way, drop down occasionally to the coast, as they have procured slaves. The third class consists of such as travel by water up the great rivers, in their canoes, which are very long, well-armed, and carry from 50 to 70 hands. These often proceed to the distance of 1000 miles, and bring down from 60 to 120 slaves at a time. The fourth class includes those who, living near the banks of the rivers, or the sea-shore, scarcely travel at all, but coming by some means or other into the possession of slaves, either drive them, or send them immediately to the ships and factories. Most of the traders now described traffic on their own account; but there are some of the poorer sort, who travel for the ships. The different sorts of goods, with which the traders deal for slaves in the inland country, may be divided into three sorts, *viz.* East Indian, home-made or colonial, and Venetian. The first consists of cowries, or small shells, which pass for money on some parts of the coast; blue and white basks, romals, bandanoes, and other cloths and productions of the East. The second consists of bar-iron, muskets, powder, swords, pans, and other hardware; cottons, linen, spirits in great abundance, with other articles of less note. The third consists totally of beads. Almost every ship carries the three sorts of articles now stated, but more or less of one than of the other, according to the place of her destination; every different part of the coast requiring a different assortment, and the Africans, like the Europeans, repeatedly changing their taste. This is particularly the case with respect to beads. The same kind of beads, which finds a market one year in one part of the coast, will probably not be saleable there the next. At one time the green are preferred to the yellow, at another the opaque to the transparent, and at another the oval to the round.

The slave-trade, at the time of its subsistence, may be said to have begun at the great river Senegal, and to extend to the farther limits of Angola, a distance of many thousand miles. On the rivers Senegal and Gambia, the Europeans proceed in their ships till they come to a proper station, and then send out their boats armed to different villages; and on their approach to them, fire a musket, or beat a drum, to apprise the inhabitants that they are in want of slaves. The country people supply them in part, and they also procure them from the large canoes above-mentioned.

The Moors, who inhabit the left bank of the river Senegal, are notorious for depredations of this sort. They cross the river without any previous provocation, and make war upon those on the other side of it, and bring them in as prisoners, and sell them at Fort St. Louis for slaves. Mr. Kiernan has seen the remains of villages, which they had broken up in such expeditions.

Captains Hills and Wilson, and Mr. Wadstrom, and lieu-

tenant Dalrymple, inform us, that the kings in this part of the country do not hesitate to make war upon their own subjects, when in want of money. They send out their soldiers in the night, who lying before, or attacking or burning a village, seize such as come out of it, and return with them as slaves.

On the river Sierra Leona there are several private factories, belonging to the merchants of Europe, in which their agents, being white people, resided. These agents kept a number of boats, which were sent up the river for slaves; and thus they procured for the factories a regular supply.

On the Windward Coast, which reaches from Cape Mount to Cape Palmas, the natives, when they have any slaves to sell, generally signify it by fires. Practices similar to those already recited prevail from the river Gambia to the end of the Windward Coast. Lieutenant Storey says, that public robbery is here called war. Mr. Bowman, another evidence, says, that when parties of robbers were setting fire to villages, war was said to be carrying on. This account is confirmed by Mr. Town and Sir George Young, and all of them concur in stating, that these parties go out at night, break up villages, and carry off the inhabitants as slaves. Messrs. Town, Bowman, and Storey, have seen them set out upon such expeditions; and the latter, to satisfy himself, accompanied them on one occasion. These came to a town in the dead of the night, set fire to it, and took away many of the inhabitants. The above practice is so common, that both up the river Scaffus, Sierra Leona, and Junk, and at Cape Mount and Bassau, the remains of burnt and deserted villages are to be seen, on which such attacks have been made, and that the natives are found to be constantly armed. In one of the towns, two or three houses only are described to have been left standing, and two plantations of rice, which were ready for cutting down, but which the inhabitants, by being carried off, had been deprived of enjoying. Lieutenant Simpson, of the royal marines, another evidence, understood that the villages on the Windward Coast were always at war; and the reason given was, that the kings were in want of slaves. Mr. Morley, another evidence, speaks in the same language. Slaves, he says, are generally made by robbers going from village to village in the night.

The Gold Coast, which is next to the Windward Coast, presents us with the same melancholy scene. The Rev. Mr. Quakoo, who had resided as chaplain to one of the factories there for many years, informed lieutenant Simpson that wars were often made for the sole purpose of making slaves. Dr. Trotter says, by prisoners of war, the traders mean such as are carried off by robbers, who ravage the country for that purpose; the Bush-men making war to make trade, being a common way of speaking among them; and in a large cargo of slaves, he could only recollect three who had not been so obtained. Surgeon Falconbridge defines the term war, when used by the slave-dealers on this part of the coast, to mean a piratical expedition for making slaves. Mr. Morley says, what they call war, is putting the villages in confusion, and catching the inhabitants, whom they carry down to the coast and sell, where, it is well known, no questions are asked how they had been obtained. Indeed a slave-captain, when examined by the house of commons, acknowledged, that he believed a captain would be reckoned a fool by any trading man, to whom he should put such a question. And Mr. Marsh, the resident at Cape Coast castle, told Mr. How, that he did not care how the slaves he purchased had been obtained; and showed him instruments which were put into the slaves' mouths, to prevent

vent their crying out for assistance, while the robbers were conveying them through the country.

From the end of the Gold Coast to the extremity of Angola, which is the boundary of the slave-trade, and which vast districts comprehends many navigable rivers, we are shocked by the repetition of the same atrocious practices. Here, as before, going to towns in the night, setting them on fire, and seizing the people, or putting the villages in confusion, and catching the inhabitants, are called *war*. These piratical expeditions are frequently made by water in these parts. Mr. Douglass says, when a slave-ship arrives, the king sends his war-canoes up the river, where they surprise and seize all they can. Surgeon Falconbridge, Mr. Morley, and Mr. Isaac Parker, confirm the account. Up the great rivers Bonny and Calabar the king sends fleets of canoes, with armed men, which return with slaves. Mr. I. Parker was twice up the river Calabar in one of these fleets, and perhaps the only white person who was ever permitted to go with them. In the day-time, he says, when they approached a village, they lay under the bushes; but at night flew up to it, and seized every one they could catch. In this way they proceeded up the river, till they had gotten forty-five persons, which they brought back to New Town, and sold to the European ships. About a fortnight afterwards, he was allowed to accompany them on another expedition. Here, he says, they plundered other villages higher up the river than before, taking men, women, and children, as they could catch them in their huts. They seized on much the same number, and brought them to New Town, as before.

On the Gold Coast, a vessel seeking slaves, generally anchors at Annamaboe. A certain quantity of gold must be included in the articles designed for purchasing slaves, or else none can be obtained. At Whidah, Bonny, Calabar, Benin, and Angola, gold is not demanded in exchange; and boats are unnecessary, except for reaching the shore, wooding and watering, and services of a similar kind. This is particularly the case at Calabar and Bonny, which have been the greatest markets for slaves. The traders of the first class, after an absence of about nine days, have returned frequently with 1500 or 2000 slaves at a time.

The number of slaves that have been annually transported from the African coast has fluctuated according to circumstances. In the year 1768, 104,000 natives of Africa were taken from their own continent; and it continued much the same for the next five years. During the American war it was diminished. In the year 1786 the numbers may be stated at 100,000, and the ships that conveyed them to the colonies at 350. The trade, before the abolition, was confined to the English, Dutch, Danes, Portuguese, and French. England, in 1786, employed 130 ships, and carried off about 42,000 slaves. These were fitted out from the ports of London, Bristol, and Liverpool; the latter of which alone sent out 90 vessels.

The unhappy slaves are divided by Mr. Clarkson into seven classes. The most considerable, and that which contains at least half of the whole number transported, consists of kidnapped people. This mode of procuring them includes every species of treachery. Mr. Wadstrom tells us, that at Dakard lived one Ganna, who was a notorious man-stealer, and employed as such by the merchants there. He saw a boy and a woman there in confinement, both of whom had been stolen. The boy had been privately taken from his parents, in the interior part above Cape Rouge; and the woman from her husband and children at Rufisque. He saw afterwards many of the natives, who had been thus taken, brought to Goree. At Sallum the king sent for

a poor woman, under pretence of buying her millet, and then seized and sold her. General Rooke, who was governor of Goree, detected three young persons who had been stolen and brought there; and at their request, he sent them back to their friends. The same governor was applied to by three slave-captains, to kidnap one hundred and fifty men, women, and children, the king of Cayor's subjects, who had come to Goree in consequence of the friendly intercourse which had subsisted between him and that king. He refused, and was much shocked by the proposition; but the captains said, such things had been done by a former governor of the place. Captain Wilson says, that in his time, when he commanded the *Racehorse* ship of war, such private robberies were frequent on the continent, opposite to Goree. His predecessor, captain Lacy, had sent one of the natives into the country with dispatches on his Britannic majesty's account; but the poor man was soon way-laid, seized, and sold. Captain Wilson rescued him afterwards from the hold of a slave-vessel, where his life had been endangered by the inhumanity of the French captain. So generally prevalent were these robberies, that they were acknowledged by all. It was the first principle of the natives, never to go out unarmed while a slave-vessel was upon the coast, for fear of being stolen. When he has met them armed, and enquired the reason, they have pointed to a ship of this description then lying at Portudal, and said, their fears arose from that quarter. Captain Hills, when he commanded the *Zephyr* sloop of war on the same part of the coast, came to the knowledge of facts similar to those related. He tells us, he knew the same Ganna mentioned by Mr. Wadstrom, and that this very Ganna offered him a young man for sale, whom he had kidnapped; and that all the natives went armed, for fear of being so taken. Captain Hills, while lying in the river Gambia, expressed a wish, in the hearing of the black pilot, to obtain a few black volunteers for his ship. Upon this the black pilot called to two boys, who were on the shore carrying baskets of shallots, and asked captain Hills if he thought the boys would suit him; in which case, he would take them off, and bring them on board. The captain declined taking them. The black pilot appeared much mortified, and said that the merchantmen would not have refused such an offer. On the Windward Coast, robbery of this kind was so notorious, that, according to sir George Young and captain Thompson, it went by a distinct name. It was there called *panyaring*. Many are the instances testified in the evidence of this kind of depredation, and this all over the coast. Let the following suffice. At Sierra Leona a beautiful boy is stolen. Off Galenas a trader, returning home with goods, is seized by the way, and sold. Lower down a young man is surprised on the beach, and disposed of in the same manner. Off Piccanini Sestus not only a young girl is kidnapped, but her kidnapper is seized in turn, and sold to the same vessel. To the right of Piccanini Sestus a young man is invited to a feast, and then betrayed and enslaved. A little farther on, a countryman, having occasion to go to a black trader's house, the trader asks him if he had seen a ship: the other replying, no; he then engages to shew him one. Taking him on board a vessel, he receives the money for him, and leaves him there. A young woman comes out of the woods at Bonny Point to bathe: robbers watch her, and then seize her, and sell her. Three persons, crossing the river Benin, are overtaken by a black trader and his people in one of their large canoes, and carried to a ship, and sold. On the other side of the river Benin, a woman is kidnapped, as she is returning from a visit; and a father and his son, as they are planting yams for food; and all of them

them passed down to the shore, and disposed of in the same manner.

The second order of slaves, and that not inconsiderable, consists of those whose villages have been depopulated for obtaining them. The third class consists of such as have been said to be convicted of crimes. Captain Wilson says, that such as are sold on this account are sold for the benefit of their kings or judges. On asking king Dame's officer, who had brought down a culprit for sale, whether the man was guilty of the crime imputed to him, he was answered by the officer, that this was of no consequence. Mr. Town says, it is not uncommon to impute crimes falsely, or to bring on palavers, that is, accusations or trials, in order to make slaves. Mr. Morley remembers a woman sold on pretence of adultery at Old Calabar; and in the river Ambris, says Mr. Falconbridge, a king's officer wanting brandy and other goods, but having no slave with which to purchase them, accuses a man of extortion in the sale of his fish, and after a summary trial on the spot, procures him to be condemned and sold.

The fourth class includes prisoners of war; being either such as are the produce of wars that have originated in common causes; or such as have been supplied by wars made solely for the purpose of obtaining them. The fifth class comprehends those who are slaves by birth. Some traders on the coast, it is said, who have slaves in their possession, make a practice of breeding from those, for the purpose of selling to others. After having been brought up to a certain age, they are reckoned saleable. The sixth class is composed of those, who have sacrificed their liberty to gaming. The seventh and last class consists of those, who having run into debt, are seized according to the laws of the country, and sold to their creditors. The two last classes are very inconsiderable, and scarcely deserve mention.

Having lost their liberty in one or other of the ways now described, they are conveyed to the banks of the rivers, or to the sea-coast. Some are found to have belonged to the neighbourhood; others to have lived farther up the country; and others in very distant parts. It has been calculated, that some of the latter have been brought 1000 miles from their homes. Of those who come from a distance, many have travelled by water, many have been made to walk also over land. These march in droves, or cauffles, as they are called. They are secured from rising or running away, by pieces of wood, which attach the necks of two and two together; or by other pieces, which are fastened by staples to their arms. They are made to carry their own water and provisions, and some of them elephants' teeth, and other commodities, which their masters may have picked up on their route. They are watched and followed by drivers, who make the weak keep up with the strong. As they pass through different places, others, who have been reduced to slavery in a similar manner, are purchased, and added to the cauffle. Many in these cauffles speak different languages, and cannot at all understand one another.

When they reach the banks of the rivers on the coast, they are offered for sale: some to land factories, or depots kept for that purpose by the Europeans; others, where the rivers are small and shallow, to ships' boats and tenders, which are constantly plying about to purchase them; and others immediately to the ships themselves. In the rivers Senegal and Gambia, from ten to forty are brought down at a time; in the rivers Bonny and Calabar, from a thousand to fifteen hundred; and on the Windward Coast, perhaps a solitary individual, or only two or three at a time; so that slaving, as it is called, is very tedious in that quarter. All those, who are thus offered for sale, undergo previous

examination by a surgeon; and none are taken but such as are free from disorder, and in the prime of life. Indeed 25 years of age is the standard, beyond which the purchasers do not like to take them. In making their bargains, the goods as well as the slaves are valued by a medium, which is known to the parties concerned. From Senegal to the end of the Windward Coast, this medium is called a bar both by African and European brokers; on the Gold Coast and at Whidah, an ounce; at Calabar, a copper; at Benin, a pawn; and at Angola, a piece. Thus every slave is valued at so many bars, ounces, &c. Every piece of goods, every barrel of powder, every knife and cutlafs, is valued in like manner. One article is marked half a bar or ounce; another a whole bar or ounce; another five, ten, twenty, and so on. By means of this arrangement, the bill is easily made out on both sides. The Europeans reckon the amount by pen and ink; the Africans by small stones or beads. Some of the latter, however, reckon entirely by their heads, and are found to be correct.

When the slaves are conveyed to the shore, they are carried in boats to the different ships whose captains have purchased them. The men are immediately confined two and two together, either by the neck, leg, or arm, with fetters of solid iron. They are then put into their apartments; the men occupying the fore-part, the women the after-part, and the boys the middle of the vessel. The tops of these apartments are grated for the admission of light and air, and they are stowed like any other lumber, occupying such quantity of room as has been allotted to them. Many of them, whilst the ships are waiting for their full lading, and whilst they are near their native shore, from which they are to be separated for ever, have manifested great appearance of oppression and distress; and in some cases have recurred, for apprehended relief, to suicide; others have been affected with delirium and madness; others, again, have been actuated by a spirit of revenge, and have resolved on punishing their oppressors at the hazard of their own lives. In the day-time, if the weather be fine, they are brought upon deck for air. They are placed in a long row of two and two together, on each side of the ship: a long chain is then made to pass through the shackles of each pair, by which means each row is at once secured to the deck. In this state they take their meals, which consist chiefly of horse-beans, rice, and yams, with a little palm-oil and pepper. Captain Hall informs us, that they are made, after meals, to jump as high as their fetters will let them, on beating a drum. If they refuse, they are whipped till they comply. This the slave-merchants call dancing. Surgeon Falconbridge explains to us the reason of this custom, by stating that the slaves are compelled to jump for exercise; and surgeon Claxton says, that the parts on which the shackles are fastened, are often excoriated by the violent exercise they are forced to take: and of this they made many grievous complaints to him. In the same manner the song is said to be promoted among them; whereas all their songs, says surgeon Falconbridge, Mr. Morley, surgeon Claxton, Mr. Ellison, and others, are of a melancholy nature, consisting of lamentations for the loss of their country and of their friends.

When the number of slaves is completed, the ships weigh anchor, and begin what is termed the *Middle* passage, to carry them to their respective colonies. The vessels in which they are transported are of different dimensions, from 11 to 800 tons, and they carry from 30 to 1500 slaves at a time. The height of the apartments is different, according to the size of the vessel, but may be stated to be from six feet to less than three; so that it is impossible to stand erect in most

of the vessels that transport them, and in some scarcely to sit down in the same posture.

When the vessel is full, their situation is truly pitiable. A grown-up person is allowed, in the best regulated ships, but sixteen English inches each in width, two (English) feet eight inches in height, and five feet eleven inches in length; or, as surgeon Falconbridge expresses himself, not so much room as a man has in his coffin. Surgeon Wilson describes the slaves as much crowded below. He generally took off his shoes before he went down among them, and was obliged to be very cautious how he walked, lest he should tread upon them. Captain Knox admits, that they had not room to lie on their backs. It also appears, that if they are the least dilatory or reluctant in packing themselves, they are quickened by the application of the whip. Dr. Trotter says, they are so crowded below, that it is impossible to walk through them without treading on them; and also, that it is the first mate's duty to see them stowed or packed together. Those who do not get quickly into their places, are compelled by a cat-o'-nine-tails. But now their situation becomes too wretched to be described. No language has words to explain it properly. Captain Hall has often heard them cry out from below for want of air. The space between decks was so hot, that often, after he has been there but a few minutes among them, he found his shirt so wetted by perspiration, that he could have wrung it. Mr. Ellison says, that the steam from their confined bodies below comes up through the gratings like a furnace. Surgeon Wilson has often heard them complain of heat. The bad effects, which resulted from this and their confinement, were weakness and fainting. He has seen some die a few minutes after being brought up, which proceeded from corrupted air and heat jointly. He has seen others go down apparently well at night, and found them dead in the morning. He had an hospital on board, but the sick slaves were obliged to lie on the bare boards, so that the motion of the vessel often occasioned excoriations from the prominent parts of their bodies. Surgeon Falconbridge declares, that he has known slaves go down apparently in health, and brought up dead in the morning. He once opened one of them surgically, to discover with certainty what was the cause of his death; and found, from the appearance of the thorax and abdomen, that it was from suffocation. He says, that once on going below, he found that twenty of the slaves had fainted. He got them instantly hauled up on deck; but notwithstanding the quickness of his movements on this occasion, two or three of them died. And once, though he was only fifteen minutes in their room below, he became so ill himself, that he could not get up again to the deck without help; and he never was below many minutes together, but his shirt was as wet as if it had been dipt in water. He says also, that as the slaves, whether well or ill, always lie on the bare planks, the motion of the ship rubs the flesh from the prominent parts of their body, and leaves the bones almost bare. And when the slaves have the flux, which is frequently the case, the whole place becomes covered with blood and mucus, like a slaughter-house; and as they are fettered and wedged close together, the utmost disorder arises from endeavours to get to three or four tubs, which are placed among them for necessary purposes: and this disorder is still further increased, by the healthy being not infrequently chained to the diseased, the dying, and the dead. Dr. Trotter, speaking on the same subject, gives us an equal melancholy account. When the scuttles, says he, in the ship's sides, are obliged to be shut in bad weather, the gratings are not sufficient for airing the rooms. He never himself could breathe freely below, unless im-

mediately under the hatchway. He has seen the slaves drawing their breath with all that laborious and anxious effort for life, which are observed in expiring animals, subjected by experiment to foul air, or in the exhausted receiver of an air-pump. He has also seen them, when the tarpaulings have been thrown over the gratings, attempting to heave them up, crying out, in their own language, *Kickeraboo, kickeraboo*, that is, "We are dying." Most of them have been recovered, by being brought upon deck; but some have perished, and this entirely by suffocation, as they had no previous signs of indisposition.

The slaves, after having been stowed, soon begin to experience the effects that might be naturally expected from their situation. The pestilential breath of many in so confined a state renders them sickly, and the vicissitude of heat and cold generates a flux. Several die, and others are induced to destroy themselves, or to revenge themselves on their oppressors. The ships, having completed the middle passage, anchor in their destined ports; and the unhappy Africans on board are prepared for sale. Some are consigned to brokers, who sell them for the ships. With this view they are examined by labourers, who want them for their farms; and in the selection of them, friends and relations are parted without any consideration; and when they part with mutual embraces, they are severed by a lash. Another mode of sale is by vendue; in which case, they are carried to a tavern, or other public place, where, being put up to sale, they become the property of the highest bidder. These are usually such as are in a sick and emaciated state, and are generally sold for a few dollars. The third mode of selling them is by the "scramble." In this case, the main and quarter-decks of the ship are darkened by sails, which are hung over them at a convenient height. The slaves are then brought out of the hold, and are made to stand in the darkened area. The purchasers, who are furnished with long ropes, rush, as soon as the signal is given, within the awning, and endeavour to encircle as many of them as they can.

These scrambles, however, are by no means confined to the ships. They are made frequently on the shore. When the latter happens to be the case, the unhappy objects of them are shut up in an apartment, or court-yard, the doors of which being thrown open, the purchasers rush in, with their ropes in their hands, as before described.

Nothing can exceed the terror which the wretched Africans exhibit on these occasions. An universal shriek is immediately heard. All is consternation and dismay. The men tremble. The women cling together in each other's arms. Some of them faint away, and others have been known to expire. If any thing can exceed the horror of such a scene, it must be the iniquity of valuing a part of the rational creation in so debased a light, and of scrambling for human flesh and blood.

During the time that elapses from the slaves being put on board, on the African coast, to the time when the receivers leave the colonies, after having disposed of their cargoes, about 25,000 lives are destroyed, *i. e.* one-fifth, or nearer one-fourth of the number put on board. About 20,000 of those who are annually imported die during the "seasoning;" which seasoning is said to expire, when the first two years of servitude are completed. This is the time which an African must take to be so accustomed to the colony, as to be able to endure the common labour of a plantation, and to be put into the *gang*. From the period when their seasoning terminates, their situation is as follows. They are summoned at five in the morning to begin their work. This work may be divided into two kinds, the culture of

the fields, and the collection of grafs for cattle. The laft is the moft laborious and intolerable employment; as the grafs can only be collected blade by blade, and is to be fetched frequently twice a day at a confiderable diftance from the plantation. In thefe two occupations they are jointly taken up, with no other intermiffion than that of taking their fubfiftence twice, till nine at night. They then feparate for their refpective huts, when they gather flicks, prepare their fupper, and attend their families. This employs them till midnight, when they go to reft. Such is their daily way of life for rather more than half the year. They are fixteen hours, including two intervals at meals, in the fervice of their matters: they are employed three afterwards in their own neceffary concerns; five only remain for fleep, and their day is finifhed.

During the remaining portion of the year, or the time of crop, the nature, as well as the time, of their employment is confiderably changed. The whole gang is generally divided into two or three bodies. One of thefe, befides the ordinary labour of the day, is kept in turn at the mills, that are constantly going, during the whole of the night. This is a dreadful encroachment upon their time of reft, which was before too fhort to permit them perfectly to refresh their wearied limbs, and actually reduces their fleep, as long as this feafon lafts, to about three hours and an half a night, upon a moderate computation. Thofe who can keep their eyes open during their nightly labour, and are willing to refift the drowfinefs that is continually coming upon them, are prefently worn out; while fome of thofe, who are overcome, and who feed the mill between fleeping and being awake, fuffer, for thus obeying the calls of nature, by the lofs of a limb; a hand or arm being frequently ground off. In this manner they go on, with little or no refpite from their work, till the crop feafon is over, when the year (from the time of our firft description) is completed. They are badly clothed, and very feantly fed; and on fome plantations treated with great feverity.

The condition and treatment of the Africans are juftified by the affertion, that they are an inferior link of the chain of nature, and made for favery. Accordingly the inferiority of their capacities has been urged, and alfo their inability for any mental exertions and attainments. But inftances of genius and of improvement, and of skill in the mechanical arts, have been adduced, both among the ancients and moderns, fufficient to refute this objection. Some have inferred their inferiority in the fcale of nature, from their colour. We refer thofe, who wifh to fee this argument difcuffed, to Mr. Hume's Effays, Eff. xxi. p. 222, note M; Dr. Beattie's Effay on Truth; and Clarkfon's Effay, &c.

Sir George Young and captain Thompfon, both of the royal navy, and the reverend Mr. Newton, and furgeons Falconbridge and Wilfon, who were feverally called upon for their public testimony on this fubject, all declare, that the capacities of the Africans are good; and that they would be equal, under equal advantages, to thofe of the Europeans.

Mr. Wadftrom, another of thofe examined, who travelled on difcovery in Africa, by order of the king of Sweden, afferts the fame thing; for he fays, they are as capable of improvement as the whites. He found among them perfons who could manufacture gold and iron. Others made cloth and leather with neatnefs, dyeing the former, and tanning the latter. Others made indigo, falt, foap, and earthenware, with confiderable skill. He offered to produce different fpecimens of their work.

This account of their capacity and manufacture is corroborated by captain Wilfon of the royal navy, lieutenant

Dalrymple of the army, and Mr. Kiernan, three other witnesses, all of whom vifited the fame part of the coaft.

Of their fenfibility, feveral inftances occur in the evidence. Mr. Wadftrom is convinced that they furpafs in affection fuch of the Europeans as he has known, and that they are honeft and hofpitable. He has been among them without fear, though alone, and was always treated by them with civility and kindnefs. Captain Wilfon fays, that they are grateful and affectionate; that when he was many miles up their country, alone and unprotected, they treated him moft kindly, vying with each other in entertaining him, and shedding tears at his departure. Captain Thomfon, before mentioned, lieutenant Storey of the royal navy, lieutenant Dalrymple, Mr. How, the botanift, Mr. Towne, and captain Hall of the merchants' fervice, concur in defcribing them as harmlefs, friendly, hofpitable, juft and punctual in their dealings, and as capable of virtuous actions as the reft of mankind. Mr. Bowman, who refided among them as a trader, found them good and honeft, friendly and hofpitable, induftrious, difpofed to trade, raifing rice for fale. They faid, they fhould like to trade with good white men, and would foon raife more plantations of rice. Captain Hills of the royal navy has feen them raifing provifions, and drefling their corn. They appeared to him to poffefs great fenfibility. Several of them fpoke good French and Englifh.

This is the character given of them by the witnesses now mentioned. It is melancholy, however, to obferve, that as they become acquainted with the European fave-traders, their difpofition feems to be changed; and that they are belt, where they have the leaft intercourfe with the latter. Lieutenant Storey tells us, they are more honeft inland than upon the coaft. Mr. Towne, who was three or four hundred miles up the country, fays, the natives are hofpitable, kind, and ready at learning languages; that in the inland country they are innocent, but, on the coaft, their intercourfe with Europeans has made them adepts in roguery, and taught them to plunder, and pick up one another to fell. Dr. Trotter, phyfician, fays, that they are fufceptible of all the focial virtues. He has known inftances of feeling equal to thofe of any civilized people whatever, and has feen no bad habits but among thofe engaged in trade with white men. Captain Hall found cultivation in the higheft ftate at Fernandipo, where they had no trade in faves. Mr. How, the botanift, had been upon almoft every Britifh fettlement, and always found the culture in a higher degree, where there was but a little of the fave-trade; and juft the reverse, where it prevailed. The reverend Mr. Newton fays, the belt people were thofe who had the leaft intercourfe with the Europeans; and they were worfe, in proportion to their acquaintance with us; and when charged with a crime, would fay, "Do you think I am a white man?" He lived alone among the Sherbro people in fafety, who were friendly and civilized. Lieutenant Dalrymple fates, that in natural capacity the Africans equal any people whatever. They are humane, hofpitable, and well difpofed. He apprehends, that if they had a proper market for their produce, they would be as induftrious as any Europeans; for where there was no fave-trade, they were very induftrious, manufacturing cotton-cloth, working in gold, fiver, and iron, and alfo in wood and leather, making faddles, bow-cases, fceabbards, and other articles.

It appears from the above account, that the Africans are perfons of the like feelings as ourfelves; that they have the fame intellectual powers, and the fame capability of improvement; the fame focial difpofitions, and the fame moral qualifications; but that they are more or lefs in-

nocent, as they have more or less connection with the Europeans.

To one argument that has been alleged in favour of slavery, we wish to direct the attention of our readers, before we close this article. It has been said, that slavery was not formally abolished by the gospel, and that it therefore continued for a long time after the introduction of Christianity. It has been said, that St. Paul, having converted Onesimus to the Christian faith, who was a fugitive slave of Philemon, sent him back to his master. This circumstance has furnished the receivers with a plea, that Christianity encourages slavery. But they have not only strained the passages which they produce in support of their assertions, but are ignorant of historical facts. The benevolent apostle, in the letter which he wrote to Philemon, the master of Onesimus, addresses him to the following effect: "I send him back to you, but not in his former capacity, not now as a servant, but above a servant, a brother beloved. In this manner I beseech you to receive him, for though I could enjoin you to do it, yet I had rather it should be a matter of your own will, than of necessity."

It appears that the same Onesimus, when he was sent back, was no longer a slave, that he was a minister of the gospel, that he was joined with Tychicus in an ecclesiastical commission to the church of the Colossians, and was afterwards bishop of Ephesus. If language, therefore, has any meaning, and if history has recorded a fact which may be believed, there is no case more opposite to the doctrine of the receivers, than this which they produce in its support.

It is said again, that Christianity, among the many important precepts which it contains, does not furnish us with one for the abolition of slavery. But the reason is obvious. Slavery, at the time of the introduction of the gospel, was universally prevalent, and if Christianity had abruptly declared, that the millions of slaves should have been made free, who were then in the world, it would have been universally rejected, as containing doctrines that were dangerous, if not destructive, to society. In order, therefore, that it might be universally received, it never meddled, by any positive precept, with the civil institutions of the times: but though it does not expressly say, that "you shall neither buy, nor sell, nor possess a slave," it is evident that, in its general tenor, it sufficiently militates against the custom.

The first doctrine which it inculcates is that of brotherly love. It commands good will towards men. It enjoins us to love our neighbour as ourselves, and to do unto all men, as we would that they should do unto us. And how can any man fulfil this scheme of universal benevolence, who reduces an unfortunate person, against his will, to the most insupportable of all human conditions; who considers him as his private property; and treats him, not as a brother, nor as one of the same parentage with himself, but an animal of the brute creation?

But the most important doctrine is that, by which we are assured that mankind are to exist in a future state, and to give an account of those actions which they have severally done in the flesh. This strikes at the very root of slavery. For how can any man be justly called to an account for his actions, whose actions are not at his own disposal? This is the case with the *proper* slave. His liberty is absolutely bought and appropriated; and if the purchase is just and equitable, he is under the necessity of perpetrating any crime, which the purchaser may order him to commit; or, in other words, of ceasing to be accountable for his actions.

These doctrines, therefore, are sufficient to shew, that slavery is incompatible with the Christian system. The

Europeans considered them as such, when, at the close of the twelfth century, they resisted their hereditary prejudices, and occasioned its abolition. Hence one, among many other proofs, that Christianity was the production of infinite wisdom; that though it did not take such express cognizance of the wicked national institutions of the times, as should hinder its reception, it should yet contain such doctrines, as, when it should be fully established, would be sufficient for the abolition of them all. See Clarkson's Essay on the Slavery and Commerce of the human Species, passim.

SLAVE-TRADE, *Abolition of the.* It is a circumstance favourable to the historian, that this great work was never regularly attempted till our own times; because the facts relating to it being fresh in every one's memory, an opportunity has been afforded him of examining them, and of estimating their truth: hence posterity will have the advantage of having more than usually accurate statements on the subject. Mr. Thomas Clarkson, a gentleman now living, who was among the warmest patrons of this sacred cause, has published an account of the different measures pursued to promote it. These were registered at the time, either by himself, or the estimable committee which acted in concert with him. His history, in two volumes octavo, has been now more than six years before the public, and not the shadow of a doubt has been expressed as to the authenticity of any thing asserted therein; we cannot, therefore, we conceive, hand down information on this great subject in a more satisfactory manner, than by giving to the reader a concise abridgment of the work itself.

The great work of the abolition, according to Mr. Clarkson, was not the entire produce of his own day. It was too mighty to have been accomplished, either by a few individuals, or in a short period of time: it was necessary that men's minds should have been previously instructed and prepared: hence, from the very beginning of the infamous traffic, to the time when he became a public actor in the scene of its suppression, which was in the year 1787, there had not been wanting good men to lift up their voices against it: and as the sentiments of these, who were most of them authors, had been given to the public in their respective works, either in poetry or prose, for a long succession of years, hundreds of persons had been then taught in England to condemn it. These, that is, the good men just alluded to, Mr. Clarkson considers as so many necessary forerunners (indeed he gives them that title); and considers them also, though most of them lived before his own time, as so many coadjutors in the work. The first mentioned are cardinal Ximenes, the emperor Charles V., pope Leo X., queen Elizabeth of England, and Louis XIII. of France; concerning all of whom he gives anecdotes in support of the title thus given them.

Having spoken first of the men in power, Mr. Clarkson divides the forerunners who walked in humbler life into four classes. The first consists principally of persons in England, of various religious descriptions, who bore their testimony against the trade in their successive writings up to the year 1787. Among the poets were Pope, Thomson, Shenstone, and Cowper; among the divines, bishop Warburton, Rd. Baxter, Beattie, Wesley, Whitfield, Wakefield, and Paley; among the others, were Montesquieu, Hutcheson, Wallis, Burke, Pottlethwaite, Day, Hartley, Millar, and Granville Sharp. The latter, however, is to be particularly distinguished from the rest, and also to be borne in mind; for whereas the others had only handed down the traffic in question as infamous, by the mention made of it in their respective works, this good man spent whole years in bringing
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the cruelty and wickedness of it into public notice. He tried, at his own expence, the famous case of *Somerfet*, and several others, in our courts of law. He was, in fact, the first labourer in the cause. He began to be the public advocate of the oppressed Africans in 1765, and was waiting for opportunities for farther exertion in 1787, the particular epoch before-mentioned.

The second class consists of the Quakers in England. This estimable society passed a public censure upon the traffic at their yearly meeting in London, in 1727. Thus they followed up, by other resolutions as a body, in 1758, 1761, 1763, and 1772, when they had become principalled against it as against a crime of the deepest dye. In 1783 they petitioned parliament against its continuance. In this year certain members of the society thought it their duty to make their fellow countrymen at large acquainted with the horrible nature of it: these were, Thomas Knowles, George Harrison, Samuel Hoare, John Lloyd, Joseph Woods, and William Dillwyn. They formed themselves into a committee in London for this purpose; they wrote and circulated books; they conveyed also information on the subject through the London and country newspapers. It was not known, however, from whom the information came, as their names were concealed from the public. In this manner they continued to work their way from 1783 to 1787.

The third class consists of the Quakers and others in North America. The Quakers there entertained the same opinion as their brethren in England on this subject. In 1696 and in 1711, they condemned, as a religious body, this cruel traffic; and in 1754, 1755, 1774, 1776, and 1778, they not only passed resolutions against it, as far as their own members were concerned, but also against slavery itself. In process of time, however, individuals rose up out of this benevolent body, and became public labourers in the cause of the unhappy Africans. The two principal of these were John Woolman and Anthony Benezet. The former travelled many hundred miles on foot, to converse with planters, and others, on the iniquity of holding their fellow creatures in bondage; and the latter laboured for years in collecting information concerning Africa and the slave-trade, and in handing it to the world. At this time other people, of other religious denominations, came forward in North America, and contributed to increase the odium which the Quakers had been the first to excite there against the traffic; when, in 1774, James Pemberton, a pious Quaker in Pennsylvania, and Dr. Rush, an eminent physician, and a man of weight among the Presbyterians in the same province, formed a committee, in which persons of different religious sects joined for the purpose of abolishing both the slave-trade and slavery on their own continent. This committee was obliged to suspend its operations during the war with Great Britain, but afterwards resumed its functions. In 1787 it added considerably to its numbers, and took in, among others, the celebrated Dr. Franklin, who was its first president in its renovated state.

It will be proper to stop here, and to interrupt the thread of the history for a moment. It has appeared, from what has been said above, first, that Mr. Granville Sharp, the most conspicuous member of the first of the classes now mentioned, was alive in 1787, and then waiting for an opportunity of exerting himself farther in behalf of the injured Africans; secondly, that of the second class, William Dillwyn was one of a committee for the same object in the same year; and, thirdly, that James Pemberton was also alive in the very same year, and a very conspicuous member of the third. Now it happened that William Dillwyn, who had been born and long resident in America, had been in ha-

bits of intimate friendship with James Pemberton; and that in consequence of his acquaintance also with the venerable Anthony Benezet, he had been introduced, by means of a letter from him, upon coming to England, to Mr. Granville Sharp. Here then we find that a member of the second class was accidentally known to a member of the first, and also to a member of the third: thus we see how easily William Dillwyn might be made the medium through whom the members of all the classes might be easily united, if a fit occasion should offer.

To return, we come now to the fourth class of forerunners. The first in this class was Dr. Peckard, master of Magdalen college, in the university of Cambridge. This gentleman had not only censured the slave-trade in the severest manner, in a sermon preached before the university itself; but when he became vice-chancellor of it, in 1785, he gave out the following subject for one of the bachelors' prizes, "Anne liceat invito in servitute dare?" or, "Is it right to make slaves of others against their will?" At this time Mr. Thomas Clarkson, before-mentioned, who had obtained the bachelor's prize of the former year, determined to become a candidate for that of the present. He took prodigious pains to make himself master of the subject, as far as the time would allow, both by procuring proper books, and by seeing as many persons as he could of those who had been in Africa, and who had become in any degree acquainted with the nature of the slave-trade. Having thus gained a considerable stock of necessary information, he wrote his Latin essay, and having sent it in to the vice-chancellor, he soon found himself honoured with the first prize. After this, being then in London, he went down to Cambridge at the time of the commencement, in order to read it publicly, as is usual, in the senate-house. The next day he returned towards London; he was then on horseback; but while upon the road the subject of the essay entirely engrossed his thoughts; he became at times seriously affected as he travelled on. He once stopped his horse, and dismounted and sat down on a bank by the roadside. Here he tried to persuade himself, that the contents of the essay which he had read in the senate-house the day before, were not true. The more, however, he reflected upon the authorities on which he knew them to be founded, the more he gave them credit; and the more he gave them credit, the more he was convinced that it was an imperious duty in some one to endeavour to see the sufferings of the unhappy Africans to an end. Agitated in this manner, he reached London. This was in the summer of 1785. In the autumn of the same year, he found himself often similarly exercised; till at length he began to have serious thoughts of devoting his life to the cause of injured Africa. Being then but twenty-four years of age, he considered his youth and his want of knowledge of the world as a great obstacle. Many other circumstances occurred to discourage him. He thought, however, that there was one way, in which he might begin to be useful to the cause; namely, by translating his Latin essay, and publishing it in English. Accordingly he began the work, and having finished it, he was looking out for a publisher, when he accidentally met an old friend of his family, who belonged to the religious society of the Quakers. This gentleman, of his own accord, asked him why he had not published his prize essay in English. Many of his brethren (the Quakers), he said, were anxiously expecting it. Upon farther conversation, this gentleman introduced Mr. Clarkson to Mr. Phillips, a bookseller in George-yard, Lombard-street, and who was also of the religious society before-mentioned; at which interview it was agreed that the latter should immediately

mediately publish the work. In a short time after this, Mr. Phillips introduced Mr. Clarkson to Mr. Dillwyn of Walthamstow, one of the second class of coadjutors before-mentioned, with whom he spent the day. Here it was that he heard for the first time of the labours of Mr. Granville Sharp. But how surprised was he to learn that Mr. Dillwyn had two years before associated himself with five others (as has been already mentioned), for the purpose of enlightening the public mind in England on this great subject. How astonished was he to find that a society had been formed in North America for the same purpose, with some of the principal of which Mr. Dillwyn was himself acquainted. He was almost overwhelmed with the thoughts, which darted upon him on this occasion. He could not but consider that he had been providentially led to Mr. Dillwyn's house; that the day-star of African liberty was rising; and that probably he himself might be now permitted to have the honour of becoming a humble instrument in promoting it. Soon after this he was introduced to the venerable Mr. Sharp, the last and most eminent of the second class of coadjutors, and soon after this his work came out under the title of "An Essay on the Slavery and Commerce of the human Species, particularly the African, which was honoured with the first Prize in the University of Cambridge, for the Year 1785." The work having been now ushered into the world, (this was in June 1786,) Mr. Clarkson resolved upon the distribution of it in the most select manner he could, in order that the case of the unhappy Africans might be known by those who had in some degree the power of relieving them. Accordingly, at his request, Dr. Baker, a most exemplary clergyman in London, lord and lady Scarfdale, sir Charles and lady Middleton, and Mr. Bennet Langton, the intimate friend of Dr. Johnson, of Jonas Hanway, of sir Joshua Reynolds, of Edmund Burke, and of other celebrated persons, undertook to distribute copies of it personally among their own friends, in the higher ranks of life, and to use their interest in procuring a perusal of them. Under their auspices the book was first introduced into the polite world. The mind, however, of the author became daily more and more agitated on the subject of it. He was not satisfied that what he was then doing was all that was necessary to be done; or that it was all that was required of him. To make the case of the unhappy Africans known, was desirable as a first step; but would this of itself put a stop to the horrors of the trade? He believed not: he believed there would be no hope of success, unless some one would resolve to make it the business of his life. The question then was, was he himself called upon to do it? His own peace of mind required that he should give a final answer to this question. To do this he retired frequently into solitude. The result was, after the most mature deliberation, and the most painful struggle, that he determined to devote his whole life, should it be necessary, to the cause. This determination was made about the latter end of December, 1786; in the beginning of 1787 the distribution of the essay went on, but by additional hands. Mr. Sheldon, sir Herbert Mackworth, lord Balgonie (now lord Leven), each took a part on the occasion. The Quakers joined in the distribution also, among whom, Mr. Richard Phillips (now living) is to be particularly noticed. This arrangement having been made, Mr. Clarkson was now able to devote all his time to qualify himself for the arduous situation to which he had devoted himself. He gained introductions to persons who had been in Africa and the West Indies, and obtained still farther information on the subject in its different branches. He visited slave-ships lying in the Thames, either as they came in or sailed out of port, that

he might know their construction and other particulars. He went frequently to the custom-house in London, where he learnt the nature of the articles which constituted the traffic, the loss of seamen employed in it, and other matters which he found it essential to know. He kept up a correspondence with persons in Liverpool for the same purpose. He visited also members of parliament, and this almost daily, to interest them in his cause; to give them information; to answer questions; and to explain doubts, if they had any, on any part of the subject. Among those who appeared most affected by his visits, and most anxious to co-operate with him, was Mr. Wilberforce, the member for the county of York. This gentleman not only read the evidence which Mr. Clarkson sent him on the subject, as he collected it fresh from day to day, but actually sent for, and took the pains to examine, at his own house, those persons who had given it, that he might judge for himself, from their own mouths, of the truth or falsehood of the enormities which had been charged upon the slave-trade. The same gentleman appointed also a meeting once a week, at his own house, of a few select friends, to deliberate on the propriety, and, if this were resolved upon, on the proper method of taking up the cause. These meetings continued for some time, when at length, at a dinner at the house of Mr. Bennet Langton, who has been before-mentioned, where several persons of consequence were invited for the purpose of talking over the matter, and of coming to a final determination upon it, Mr. Wilberforce pledged himself to bring forward the great question of the abolition of the slave-trade in parliament, as soon as ever he should feel himself prepared for so tremendous a task. Here then the matter began to assume a shape. A parliamentary leader had been secured, and one whose virtuous life corresponded with the sacredness of the cause which he was to advocate. Mr. Clarkson, who was present at this dinner, carried directly the news of what had taken place to several of his friends, but particularly to Mr. Granville Sharp, Mr. Dillwyn, and three or four others of the religious society of the Quakers, all of whom he had previously taught to expect such a result. The consequence was, that the following persons met the next day, and without loss of time formed themselves into a committee, "for procuring such information and evidence, and publishing the same, as may tend to the abolition of the slave-trade, and for directing the application of such monies as may be collected for the above purpose," *viz.* Granville Sharp, Samuel Hoare, George Harrison, John Lloyd, Joseph Woods, William Dillwyn, Thomas Clarkson, Richard Phillips, James Phillips, Philip Sansom, John Barton, and Joseph Hooper. Mr. Granville Sharp, the first mentioned, may be considered, from what has been before said, as representing the first of the classes which have been described. The four next were the real representatives of the second. The third class, or that of the Quakers in America, may be considered as represented in the person of William Dillwyn, by whom, indeed, it was afterwards united to the committee now formed; and Mr. Clarkson and Mr. R. Phillips as representing the fourth, most of the members of which they had been the means of raising. "Thus," says the historian, "on the 22d of May, 1787, the representatives of all the four classes, of which I have been giving a history from the year 1716, met together, and were united in that committee, to which I have been all along directing the attention of the reader; a committee, which, labouring afterwards with Mr. Wilberforce as a parliamentary head, did, under Providence, in the space of twenty years, contribute to put an end to a trade, which, measuring its magnitude by its crimes and sufferings, was the greatest practical evil that ever afflicted the

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the human race. After the formation of the committee, notice was sent to Mr. Wilberforce of the event; and a friendship began, which has continued uninterruptedly between them from that to the present day." In the following month, that is, in June 1787, the committee simplified its former title, and was ushered into the world. It professed to have nothing to do with the emancipation of slaves already in bondage. Its only object was the abolition of the African slave-trade. From this period we shall give a history of its proceedings, year by year.

The committee was no sooner formed, than Mr. Clarkson drew up "A Summary View of the Slave-Trade, and of the probable Consequences of its Abolition." It consisted only of about a dozen pages. It detailed the different methods of making slaves in Africa, their treatment, sufferings, and mortality in the passage; and also the treatment of the survivors in the colonies to which they were carried; and it promised the publication of an Essay on the Impolicy of the Slave-trade. This summary the committee determined to print, and to circulate all over the kingdom. In the mean time Mr. Clarkson was to take a journey to the different slave-ports, to increase his own knowledge of the subject. Such knowledge was absolutely necessary in case parliament should call for evidence: and if there was any one time more fit than another for procuring such evidence, it was the present; for men's minds had not then been heated by talking upon the subject, nor had interest hitherto felt itself biased to conceal the truth; but as soon as ever it should get abroad that parliament was to look into the subject, all avenues to farther information would be shut against him. The first place he visited was Bristol, where he resided for some weeks. Here he obtained a knowledge of several articles of African produce, such as rice, indigo, cotton, spices, and woods, and collected specimens of them. He obtained specimens also of the different manufactures of the natives of Africa, both in wood, cotton, leather, iron, and gold. He examined the construction of slave-ships, and took the dimensions of several. He obtained histories of their former voyages. He collected chains, handcuffs, thumb-screws, and other horrid instruments used in this execrable traffic. He discovered the scandalous modes of procuring and paying those seamen who were employed in it, the sad ratio of their mortality on the voyage, and the prodigious difference between the mortality of these and of those employed in other trades, of which he was enabled to take a comprehensive view, from procuring the muster-rolls of almost every ship belonging to the port. But that which hurt his feelings the most, and which kept him indeed in a state of constant misery while in Bristol, was the barbarous usage, and this almost without an exception, of the seamen employed in this traffic. He took many out of the slave-vessels there. He took up the cause of some of these, and obtained damages for them in the courts of law. He sent a chief mate to prison for the murder of one of the crew acting under him. While at Bristol, he formed a committee to act in union with that of London, and obtained promises of petitions to parliament against the continuance of the inhuman traffic from that city, and from Bath, Monmouth, and Bridgewater. On his journey from Bristol to Liverpool, he procured the promise of similar petitions from Gloucester, Worcester, and Cheller, and secured the provincial newspapers as he travelled on in behalf of his cause. On his arrival at Liverpool, he followed the same line of enquiry as at Bristol, for six weeks, after which period (so incensed were merchants, captains of ships, and others connected with the trade, against him) it would have

been dangerous to stay. From thence he visited Lancaster, the last of the slave-ports, and at length returned to London, after an absence of five months, in the December of 1787. The committee, in the mean while, that is, during his absence, had been equally well employed, and had been equally indefatigable. The first thing they did was to make known, by public advertisement, their existence as a committee, and the great object they had in view. They ordered a seal to be engraved for their correspondence. The device upon it was a negro in chains, kneeling, and in a supplicating manner lifting up his hands to heaven. The motto round the device consisted of these words, "Am I not a man and a brother?" They then added to their committee, to increase their labourers; and having done so, they directly opened a correspondence throughout England, Wales, and Scotland, which they extended afterwards to America. This gave them an opportunity of making their cause known in the most extensive manner. Accordingly, when things had been thus prepared, they circulated many thousands of the summary views before-mentioned, and, at the same time, addressed by letter all the corporate bodies in the kingdom. These efforts soon convinced them, that there were thousands of kindred souls in their own country, who felt with them on the great subject of their institution. The Quakers were the first, as a body, to acknowledge and approve it; the general Baptists the next: then followed letters of approbation, and promises of support from people of all religious denominations. Among these were, the famous Dr. Price and John Wesley; Mr. Roscoe, the historian and poet; Dr. Porteus, bishop of Chester; Dr. Woodward, bishop of Cloyne; Dr. Hinchliffe, bishop of Peterborough; Dr. Horne, afterwards bishop of Norwich; Dr. Bathurst, now bishop of the same; archdeacons Paley and Plymley (now Corbett); the celebrated marquis de la Fayette, now alive, who was soon afterwards conspicuous in the French revolution; and Brissot and Claviere, afterwards two distinguished members of the national convention in France, and who suffered under the tyranny of Robespierre. This good feeling continued to spread, when, in the month of February, 1788, there appeared to be among the people of England a general feeling in behalf of the injured Africans. By this time thirty-five petitions had been presented to parliament from different places, praying for the abolition of the slave-trade, and several others had been resolved upon. These proceedings produced such an effect upon the government, that the king was advised to order a committee of privy-council to inquire into the nature of the slave-trade. This order was dated February 11. An inquiry was of course immediately set on foot. The first witnesses examined, were persons sent expressly as delegates from Liverpool, who had not only been themselves in the trade, but who were then interested in its continuance. These endeavoured to shew, that none of the enormities with which it had been charged belonged to it; and that it was even attended with circumstances favourable to the unhappy victims of it. A great prejudice therefore was excited, in the very beginning of the inquiry, in the minds of some of the privy-council against the abolitionists; whom they considered as misinforming the public mind with respect to a traffic, which appeared to be so vitally connected with the manufacturing and commercial interests of the country, that it would be almost national ruin to abolish it. Happy was it for the cause, at this moment, that Mr. Clarkson had taken his journey to Bristol and other places, as before-mentioned; for he had become acquainted, in the course of it, with persons who had witnessed the horrors of the trade; but who, having then quitted it, had no
interest

interest in concealing the truth. These, though few, were highly respectable; and their evidence, when called before the council, contributed to counteract that of the Liverpool delegates, and others, and to turn the tide, which had run so strong against the abolitionists, in their favour. The inquiry which had been thus set on foot, continued through February, March, April, and a part of May. During this time the petitions from the people to parliament had increased to one hundred and three. The committee also had circulated many new books throughout the kingdom, written by eye-witnesses of the several facts they contained, and all contributing to give new information, and to add new horror to the trade. Mr. Wilberforce also had been preparing to introduce the subject into parliament; but at the time when his motion was expected, he was too ill to make it. Indeed, his life was despaired of. Under these circumstances, his friend, Mr. Pitt, then chancellor of the exchequer and prime minister, undertook to supply his place. On the 9th of May he opened the business in the house of commons, and concluded by a motion, "that this house will, early in the next session of parliament, proceed to take into consideration the circumstances of the slave-trade complained of in the petitions, and what may be fit to be done thereupon." A discussion took place in consequence, during which there was an apparent enthusiasm in the house in behalf of the injured Africans. The members for Liverpool, however, denied the existence of any of the cruelties complained of; but they did not oppose the motion, and therefore it was unanimously agreed to. This pledge having been given by parliament, the public seemed satisfied with it, and of course nothing more was expected in that session; when, on the 21st of May, sir William Dolben suddenly rose up in the house of commons, and moved for leave to bring in a bill on the subject of the slave-trade. As the trade, he said, was evidently allowed to go on till the next session, he thought it was the duty of the house to take care that it should be carried on with as much humanity as possible in the interim. His great object, therefore, was to alleviate the sufferings of the poor Africans in their transportation, by allowing them more room, which might be done by regulating the number to be carried by the tonnage of the vessel. Leave was accordingly given; but the merchants of Liverpool determined to oppose the bill in every stage. They dispatched immediately to London those very persons to be examined before the house, whom they had before sent for examination to the privy-council. When counsel had closed their case, a debate ensued, in which the statements of these witnesses were exposed, greatly to their mortification, and the bill passed by a majority of fifty-five to five. It was then carried to the lords. Here a still more determined opposition was begun, and carried on in such a manner, and with so much apparent success (the house being very thin at that season), as to alarm the abolitionists, not only for the fate of the bill itself, but for that of their great question the ensuing year. At length it passed the upper house, as through an ordeal of fire, and received the king's assent, on July 11. During all this time, the privy-council continued their examinations. Mr. Clarkson underwent an examination among others. It was at this time that he brought out his powerful essay on the impolicy of the slave-trade. This was circulated in great numbers by the committee, upon whom too much praise cannot be bestowed for their labours. From July 1787 to July 1788, the time we are now come to, they had held fifty-one long committees: they had held as many more sub-committees: they had distributed (besides 26,526 reports, debates in parliament, and other

matters) 51,432 pamphlets or books. They had roused the feelings of the whole English nation, and had attracted the notice of some of the most distinguished persons in France and Germany.

The session of 1788 was no sooner over, than Mr. Clarkson undertook a journey to all the sea-ports of the kingdom lying between Kent and Cornwall. His object was to find out, if possible, new witnesses to strengthen the good cause. He met with considerable success in his journey, and he formed committees, auxiliary to that of London, as he went along. On his return to London he was again examined by the privy-council, to whom he shewed, by way of evidence, his collection of African curiosities, consisting of produce and manufactures, which he had now completed. He introduced also to their lordships, for examination, all the new witnesses he had discovered, and whose testimony was of the highest value. The committee, in the mean time, had been indefatigable. They had directed their correspondence to new parts of the kingdom, as well as of North America. They had addressed the rulers of Spain, Portugal, and Sweden, in behalf of their institution, and had opened a communication with Germany on the same subject. They had printed and circulated no less than five new works to promote their cause, and, besides, that famous engraving of the section of the slave-ship (where the bodies of the negroes were seen packed in the different parts of it), which afterwards excited such universal sympathy in the country, and which caused such an universal abhorrence of the trade. About this time, that is, on the 19th of March, 1789, Mr. Wilberforce, who was then but just recovered from his long and severe illness, moved in the commons, that the house should on Thursday, the 29th of April, take into consideration its own resolution of the last session. This motion was agreed to, but it became immediately the signal to all those who supposed themselves interested in the continuance of the trade, such as planters, mortgagees, merchants, manufacturers, and others, to begin a tremendous opposition. Meetings were called, and frightful resolutions entered into. The public papers were filled with them. Here, as well as in pamphlets, the most bitter invectives were poured forth against the abolitionists. Emancipation was industriously confounded with abolition. Compensation was demanded to a most monstrous degree. The cry, indeed, was such, that many began to be staggered about the propriety of the total abolition of the trade. At this time Mr. Pitt, his majesty's chancellor of the exchequer, laid the privy-council report, consisting of the examinations before-mentioned, which came out in the shape of a large folio volume in print, upon the table of the house of commons, and moved, in order that members might have time to become acquainted with the evidence it contained, that the consideration of the slave-trade, which stood, by Mr. Wilberforce's motion, for the 29th of April, should be postponed to the 12th of May. This was agreed to. On the day appointed, Mr. Wilberforce rose, and in a speech of three hours and a half, introduced the great question into parliament. He reasoned entirely from the evidence contained in the report just mentioned, and deduced from it twelve grand propositions, which he read, and then laid them upon the table. These propositions contained the whole question. He wished them to be argued at a future day. Upon this, great opposition was manifested by the members for Liverpool and others, and a warm debate took place, when it was agreed that they should be taken into consideration on the 21st of May. When the day arrived, several petitions were presented to the house,

by persons interested in the traffic, against its abolition. Mr. Wilberforce rose up and addressed the house. After this, an altercation took place rather than a debate, in which much heat and animosity were manifested. Those members who espoused the cause of the interested persons, seeing that it would be overthrown, if they judged of the merits of it by the privy-council report, would not now abide by the latter; but rejected it as an imperfect sort of evidence, and demanded that witnesses should be heard at the bar of the house of commons in explanation of many of the mis-statements which that book contained. By these means they endeavoured to get rid of the propositions altogether. Their demand, however, after a good deal of contention, was complied with, and on the 26th of May counsel were heard, and one witness, a slave-captain, was examined. Their object now was to interpose every legal species of delay, and in this they succeeded so well, that from the 26th of May to the 9th of June, only two of their witnesses had been examined. In this slow way they went on till the 23d of the same month, when it was seen that it would be utterly impossible to bring the question to a final decision in that session, for they declared that they had many evidences yet to produce, and that they must and would be heard. Accordingly they moved, and Mr. Wilberforce agreed, that the farther consideration of the subject should be postponed to the next sessions.

As those who were interested in the continuance of the trade had now got rid of the privy-council report, and had introduced new evidences to the commons in behalf of their case, it became the committee to collect as respectable a body of witnesses as possible on their own side of the question. Mr. Clarkson had undertaken to traverse the kingdom again for this purpose, and had set out, when, hearing that the French revolution had broken out, and that a committee for the abolition of the slave-trade had been formed in Paris, he returned, and immediately hastened to the latter city, where he arrived at the latter end of July. He soon became acquainted with the marquis de la Fayette, monsieur Necker, the duke de la Rochefoucauld, the marquis de Condorcet, and Messrs. Mirabeau, Petion, Brissot, Claviere, and other distinguished persons. He spent his time, while in Paris, in attending the committee there, in visiting members of the National Assembly, and in the personal distribution of books among them, but particularly his "Essay on the Impolicy of the Slave-Trade," which he had caused to be translated into French for that purpose. Returning to London in January 1790, he found that Mr. Wilberforce had carried a motion in the commons, that witnesses should not be examined in future at the bar of that house, but in a committee-room, which should be open to all members. This was necessary for the sake of dispatch, as the examinations otherwise might have taken up ten years. Mr. Clarkson now resumed the journey which he had begun in the preceding summer, in search of new and respectable witnesses. He made a tour of 1200 miles in three weeks, during which he found out sixteen persons capable of giving good testimony on the subject, but could only prevail upon three to be examined. On his return to London, he found that the examinations of witnesses in behalf of those interested were going on in the committee of the house of commons, and with so much rapidity, that it was expected their case would be soon closed. This alarmed him exceedingly; for out of seventeen persons who stood upon his list as having promised to give their testimony in behalf of the abolition, one had lately died, and no less than eight, being seafaring persons, were then out of the kingdom. He determined, therefore, upon another journey; and on

turning the subject over in his mind, he thought he should obtain the greatest number of disinterested witnesses in the shortest possible time, if he could go on board all the ships of war lying in ordinary at the king's ports in different parts of the kingdom. Impressed with this idea, he went to Deptford, and first boarded all the men of war that were lying there. He then proceeded to Woolwich, and afterwards to Chatham, Sheerness, Portsmouth, and Plymouth, where he boarded others in like manner, to the number altogether of four hundred, in which he picked up several very excellent and important witnesses. On the 20th of April, the persons interested had just closed their case. Accordingly Mr. Wilberforce moved, on the 23d of the same month, in the house of commons, that witnesses should be heard in behalf of the abolition. Upon this much clamour ensued. The members, who acted in union with the persons interested in the continuance of the slave-trade, wished to have the case directly argued, that is, upon their own evidence, and without hearing any on the other side, and resisted accordingly. Their opposition, however, proved ineffectual against the eloquence of Mr. Wilberforce, supported powerfully as he was by that of Mr. Pitt and Mr. Fox. At length, the witnesses in behalf of the abolition took possession of the ground which the others had left, and no less than twenty-four, some of whom had been found out since the last tour, were examined before the close of the session. At this time it is very curious to remark, that the feelings of parliament, and those of the people, were very different on this great question. The tide certainly ran against the abolitionists in the house of commons. The old hue and cry had been revived of intended emancipation under the pretence of abolition; of monstrous indemnification to the planters; and of the certain massacre of the whites by the negroes, if the trade were to be abolished, but in more furious language, and to a greater extent than before. The feeling, on the other hand, in the country, was warmly on the side of the abolition. It had been kept up and increased by various circumstances. The committee had been daily employed in answering, through the medium of the public papers, every objection which had been started as hostile to their cause. They had also by this time distributed all over England, Scotland, and Wales, the horrible and affecting engraving of the section of the slave-ship before-mentioned. Individuals, too, had kept alive the popular feeling in various ways. Wedgwood, the celebrated manufacturer, had taken the committee's seal, as before explained, for a model, and had struck off and distributed many thousand small cameos in plaster. The ground of each of these cameos was white, but the negroe, who was seen imploring compassion on his knees in the middle of it, was of his own native colour. Cowper also, and other poets, had written beautiful and affecting songs on the subject. These were circulated very copiously through the kingdom, and some of them were sung in the very streets.

Not more than half the evidence, which was deemed necessary, having been heard on the side of the abolition in the session just passed, it became an imperious duty in the committee to use every possible exertion to complete it, and this in the best possible manner, before the next. Such exertion was absolutely essential to victory. Mr. Clarkson was, therefore, again solicited to traverse the kingdom for this purpose. This journey being of the utmost importance, Mr. Wilberforce prepared an ingenious list of questions to assist him in his examinations and inquiries. With this he departed, and travelled from August 1790, to February 1791, during which time he went over the greatest part of the

the island, and had the good fortune to add a considerable number of new and important witnesses to his list. At length the examinations were resumed in the committee of the house of commons, and they were closed finally on the 4th of April. No less than sixty-nine persons had given their testimony in this and the preceding session in behalf of the abolition of the slave-trade. The evidence having been printed on both sides for the use of the members, as the basis upon which to argue the case, the 18th of April was fixed upon as the day for deciding it. By this time every effort had been made by the persons interested to render the question unpopular in the commons. Emancipation, indemnification, massacre, ruin, had been vociferated over and over again in the ears of the members there. At this time, unhappily the most sanguinary scenes were taking place in St. Domingo, in consequence of the revolution which had been effected there, and an insurrection had broken out in the British island of Dominica. All these had been industriously detailed in print, but with great exaggeration, and added to the cries just mentioned. This union of reports and cries had produced such a terrific effect upon many members, that they considered the abolitionists, by persevering in their question, as ferocious monsters; and in this unfavourable frame of mind they went into the house on the day fixed for the discussion, to discharge their duty with respect to this great question. On this day, namely, the 18th of April, 1791, Mr. Wilberforce made a most luminous and affecting speech, in which he took a most masterly view of the whole question in all its different departments, as it related both to Africa and the West Indies. He argued the inhumanity of the traffic; he argued its impolicy; he appealed to feeling; he appealed to reason; he tried to disarm his opponents by candour; he exhorted them to attend to their own interest; and concluded by moving for leave to bring in a bill to prevent the farther importation of slaves into the British colonies in the West Indies. After this, a most serious discussion ensued, which lasted till three in the morning, when several members, being yet desirous of speaking, the business was adjourned to the next day. It was then argued again till half past three in the morning, when the house divided on the original motion. There were for it but 88 votes, and against it 163; so that this great cause of humanity, justice, and religion, which had cost so many years of labour, was lost by a majority of 75 votes. Upon the news of this signal defeat, the committee for the abolition of the slave-trade held a meeting, which was conducted with the most solemn dignity. They voted thanks to the illustrious minority which had lately stood forth the assertors of British justice and humanity, and the enemies of a traffic in the blood of man; and entered into several resolutions, the substance of one of which was, that they considered the late decision of the house rather as a delay than a defeat; that they did not despair of final success; and that they would never desist from appealing to their countrymen, till the commercial intercourse with Africa should cease to be polluted with the blood of its inhabitants. These resolutions were followed up by a suitable report, and sent to all the country committees throughout the kingdom. At length the session ended, and a cruel one it had proved to those who had interested themselves in the abolition of this cruel traffic. The defeat, however, which they had experienced, had been rendered more tolerable, because, in consequence of the unjust clamours by which the minds of many members of parliament had been affected, it had been expected. It had been rendered more tolerable again, by knowing that several of the most distinguished characters in the kingdom,

and all of splendid talents in the house of commons, such as Pitt, Fox, Burke, Grey, Sheridan, Wyndham, Whitbread, Courtnay, Francis, Rider, W. Smith, and H. Thornton, had supported the sacred cause; and because a bill had been carried through both houses of parliament in this very session for the establishment of the Sierra Leona company, the object of which was to form a settlement on the coast of Africa, which should be made a medium for civilizing that continent through two channels, viz. by the introduction of a new species of commerce there, and of cultivation also in its neighbourhood, on the principle of free labour.

The people of England, soon after the news of the defeat just spoken of had been communicated to them, began to be sensibly affected, and many, in order to wash their hands of the blood of Africa, left off the use of fugar. Mr. Clarkson, after a consultation with Mr. Wilberforce and the committee, undertook to abridge the evidence which had been offered to the house of commons on the side of the abolition, with a view of circulating its horrible contents through the kingdom, and of thus making the public impression still deeper. This abridgment was begun in June 1791, and was written, printed, and in the hands of all the committee's correspondents in England, Wales, and Scotland, by the latter end of September. Mr. Clarkson now undertook to follow the book, and to see, if possible, that it was actually read. Accordingly he left London in the beginning of November. It was his intention to wait personally upon every person in every county in the kingdom, to whom the book had been sent, to get others of the town or neighbourhood to meet him there, to converse with them on the subject, to treat their individual perusal of the abridgment, and their united efforts in lending it out judiciously, and in seeing that it was read. This he attempted to realize, but the process was very tedious. He had travelled 6000 miles in the execution of his plan, when he found that he had yet 4000 to go. To perform this was impossible, so as to answer the purpose. He therefore made his situation known to the committee. The consequence was, that Dr. Dickson, a gentleman who had greatly assisted the cause by his writings, set off from London, and took the whole of Scotland off his hands. The result of the two journeys was soon visible. The people could not bear the facts which the abridgment had disclosed to them. Great numbers left off immediately the use both of fugar and rum. The great bulk of the nation, however, vented their feelings in public meetings to address the legislature on the subject, and this they did with so much earnestness and activity, that by the latter end of the month of March, 1792, no less than 517 petitions, including several from whole counties, were laid on the table of the house of commons, praying for the total abolition of the slave-trade. Emboldened and supported in this manner by the voice of the people, Mr. Wilberforce introduced the question again into the commons. This was on the 2d of April. After a speech of four hours, during which he added a profusion of new light to the subject, and during which he endeavoured, in the most mild and persuasive manner, to do away objections and prejudices, he moved, "that it is the opinion of this house that the African slave-trade ought to be abolished." This led to a very long and uncommonly interesting debate. Never, certainly, in the house of commons, and never probably in any other place, was so much splendid oratory displayed, as on that night, on the side of the abolition of the slave-trade. It appeared, in the course of the debate, to be the sense of the house, that some sort of abolition should take place. Two divisions took place. In

the first, there were 193 votes for gradual abolition, and 125 for immediate; and in the second, there were 230 for gradual, and 85 for no abolition at all. In this state the question was left till the 23d of April, when Mr. Dundas (afterwards lord Melville) came forward and proposed a plan conformable with the resolutions of the house just mentioned. The outlines of it, however, were opposed by Messrs. Pitt, Fox, and Wilberforce, not only as being very defective, but as built upon false data. The business was accordingly adjourned to the 25th. On that day, Mr. Dundas brought forward the subject again. He considered that eight years ought to be allowed the planters to stock themselves with negroes, and therefore moved that the year 1800 should be the epoch, after which no more slaves should be imported from Africa in British vessels to the West Indies. Lord Mornington (now marquis Wellesley), in a most brilliant speech, moved an amendment, which was, that the year 1793 should be substituted for that of 1800. There appeared, on a division, to be 158 for Mr. Dundas's motion, and 109 for the amendment. On the 27th of April the subject was resumed in the house. Mr. Dundas proposed the year 1800, as before, and lord Mornington the year 1795. His lordship's motion was again lost, but by a less majority than on the former occasion, *viz.* by 161 to 121, when sir Edward Knatchbull struck out a middle line, by proposing the year 1796, which motion was carried by a majority of 151 to 132. The gradual abolition having been thus agreed upon for 1796, a committee of the commons carried the resolution to the lords. On the 8th of May the lords met to consider it, when, cruel to relate, a motion was made by lord Stormont, on the part of the planters, merchants, and other interested persons, to hear new evidence. This, after some little opposition, was acceded to. On the 15th of May, the first witness on this side of the question was introduced; and on the 5th of June, when only seven witnesses had been examined on the same side, all further examination was postponed to the next session.

Nothing could be more distressing to the abolitionists than the determination of the lords now mentioned; first, because there was no saying how many, even years, the hearing of evidence there might take; and secondly, because they (the abolitionists) had the laborious work to do over again, of finding out and keeping up a respectable body of witnesses on their own side of the question. This latter work was essentially necessary; for it was impossible to allow the persons interested to throw in a weight of testimony for the furtherance of their own cause, and not to take means to counteract it. Mr. Clarkson, therefore, set out again in the month of July, on his old errand. Dr. Dickson, the gentleman before-mentioned, left London about the same time, in order to assist him. He was to take a different route, which had been before settled. They were very successful in their respective journeys, and both returned in the month of February, 1793. The house of commons was then sitting. The only step to be taken there (but this was essentially necessary), was to bring before it, in some part or other of the session, its own vote of the former year, by which the slave-trade was to be abolished in 1796, in order that this vote might be reconsidered and renewed. Accordingly Mr. Wilberforce moved the house upon the subject. It is only necessary to state, that his motion was most furiously opposed, and actually lost by a majority of 61 to 53. By this determination the commons actually refused to sanction their own vote. In this distressing situation, Mr. Wilberforce scarcely knew what to do. He was not, however, to be dismayed by one un-

expected defeat. He resolved, therefore, that he would not allow the session to pass without trying the question in some other shape. Accordingly, in the month of May, he moved for leave to bring in a bill to abolish that part of the trade by which the British merchants supplied foreigners with slaves. His motion was carried, but only by a majority of 7; and, alas! on the third reading, it was lost by a majority of 31 to 29! During all this time the examination of witnesses had been going on in the house of lords. Only seven witnesses, however, had been heard there in the course of the whole session.

After this most cruel session, the abolitionists were at a loss how to act for the advantage of their cause. One measure, however, was obviously necessary, *viz.* to endeavour to keep up a respectable body of evidence to oppose that which should be heard against the abolition in the lords. For this purpose, Mr. Clarkson, at the request of the committee, once more traversed the kingdom. He began his journey in September, and returned in February, 1794. Mr. Wilberforce, in the interim, moved in the commons for leave to renew his former bill for the abolition of the foreign slave-trade, as carried on by British subjects. He carried it, though with great difficulty, in all its stages, through the house of commons; but it was almost directly lost in the house of lords. In this latter house only two evidences had been examined in the course of the session. At this time Mr. Clarkson was in such a wretched state of health, as to be unable to lend any farther assistance to the committee. The incessant labour of body and mind for so many years, aggravated by anxiety and disappointments, had made a very serious inroad upon his constitution. His nervous system had been literally shattered to pieces; his hearing, memory, and voice, were nearly gone. He was, in short, utterly incapable of any farther exertion; and he was therefore obliged, though very reluctantly, to be borne out of the field, where he had placed the great honour and glory of his life. The question was now in a very desperate state, for if the house of commons would not renew its own resolution, and if the lords would not abolish even the foreign part of the slave-trade, what hope was there of success? But neither, however, were Mr. Wilberforce nor the committee to be deterred by the prospect. They determined never to abandon the cause. Accordingly Mr. Wilberforce moved in the commons, in the session of 1795, for leave to bring in a bill for the abolition of the slave-trade. This motion was now necessary, and justifiable on that account, if the trade, according to a former resolution of that house, was to cease in 1796; but it was lost by a small majority.

In the session of 1796, Mr. Wilberforce resolved upon trying the question again, but in an entire new form. He moved that the slave-trade be abolished in a limited time, but without assigning to its duration any specific date. He wished the house to agree to this as a general principle. After much opposition the principle was acknowledged; but when, in consequence of this acknowledgment of it, he brought in a bill, and attempted to introduce into one of the clauses the year 1797, as the period when the trade should cease, he lost it by a majority of 74 to 70.

He judged it prudent, after mature consideration, to let the session of 1797 pass without any parliamentary notice of the subject, but in that of 1798 he renewed his motion for abolition in a limited time. This, however, met with the same fate as the former.

In 1799, undismayed by former defeats, he tried the same motion again, when there appeared for it 74, and against it 82 votes. He determined, however, that the remainder of the session should not pass without an effort to obtain some-

thing, if it were only a small part, of what belonged to the cause. Accordingly his estimable friend, Mr. Henry Thornton, lately deceased, brought in a bill, at his request, to abolish a very small part of the slave-trade. It may be remembered, that a colony had been established at Sierra Leona, to promote agriculture and a new species of commerce in its neighbourhood. Now, while the slave-trade was carried on all around it, it was found that these objects could be but little advanced. The bill, therefore, of Mr. Thornton, went only so far as to say that the slave-trade should not be carried on within a certain distance of that colony. This bill was carried through the commons, but though it only asked that an infant establishment, founded on the principles of liberty, and this by parliamentary sanction, should be protected from the ravages of the slave-trade, it was lost in the house of lords. This latter circumstance was indeed truly disheartening; yet amidst the clouds which darkened the horizon, one gleam of hope appeared; for the question had been so argued, so sifted, and put into such various lights, that it began now to be understood. The consequence was, that conviction flashed upon many, among whom were three planters, Mr. Ellis, Mr. Barham, and Mr. Vaughan. These gentlemen had the candour to rise up in the house of commons, and express themselves in favour of the abolition, in one of the last debates.

The question had been now tried and lost in almost every possible shape; Mr. Wilberforce and the committee seemed to have but two alternatives of choice left them, either to persevere against all hope, or to hold themselves in readiness to seize the first favourable opportunity which should present itself for furthering the cause. It was determined to adopt the latter, and by no means to let the question degenerate into a mere annual motion of form. It was thought proper also, as several members of the house of commons were changing their opinions on the subject, to give others time to digest the powerful eloquence which had been expended upon it. Mr. Wilberforce, therefore, suffered the years 1800, 1801, 1802, and 1803, to pass over without noticing it. In 1804, however, he resolved to renew his exertions. The committee resolved to second them, and immediately increased its number, that it might act with extraordinary vigour. The circumstance, which marked this year in particular as favourable for another trial, was the union with Ireland, in consequence of which a great number of Irish members, generous, and open-hearted, and in general friends to the poor Negroes, were added to the British parliament. Mr. Wilberforce, therefore, under these circumstances, asked leave to renew his bill for the abolition of the slave-trade within a limited time. This motion was as violently opposed as any of the former, but was carried at length in a very handsome manner: no less than 124 divided in favour of it, and but 49 against it. The bill was opposed in its second reading, for which however there were 100, and against it but 42. When a motion was made for going into a committee it was opposed, but carried by 79 to 20. The bill also was opposed in its last stage, but carried by a majority of 69 to 36. It was taken up to the lords, but on a motion by lord Hawkebury (now lord Liverpool) the discussion there was put off till the next session.

In the session of 1805, Mr. Wilberforce renewed his former motion. Leave was at length given him to bring in the bill, but not till after a most furious opposition. On the second reading of it the opposition increased, and an amendment was proposed, *viz.* to put it off to that day six months. This amendment was actually carried by a majority of 77 to 70. This defeat occasioned the abolitionists the severest disappointment. The committee instantly met, when

forrow was seen in the countenances of all present. Their first object was to endeavour to develop the causes of the miscarriage now mentioned. It appeared clearly, after the most minute examination, that these were accidental. The committee, therefore, resolved upon renewing the contest with redoubled vigour the ensuing year. Just at this moment, who should join them but Mr. Clarkson! Eight years' retirement had nearly restored him, and the first moment he found himself able to embark again in the cause, he returned to his post. As it then seemed probable that the question would be carried the next year through the commons, and, if so, that it would go to the lords, and that the lords would probably require farther evidence, it was judged proper that evidence should be prepared. But, alas! the noble band of witnesses which had been last collected, had been broken by death and dispersion, and a new one was to be formed. Herculean task! tremendous, however, as it was, Mr. Clarkson undertook it. He left London in two or three days afterward, and returned in January 1806, after having travelled in pursuit of his object above 5000 miles. In this month died Mr. Pitt, who was then prime minister, and who had been one of the great supporters of the cause.

On the 31st of March, 1806, this great question was ushered again into parliament, but under new auspices, namely, under the administration of lord Grenville and Mr. Fox. It was thought proper that Mr. Wilberforce should be as it were in the back-ground on this occasion, and that the attorney-general, as a conspicuous officer of the government, should introduce it. The latter accordingly brought in a bill, one of the objects of which was to prohibit British merchants and British capital from being employed in the foreign slave-trade. This bill passed both houses of parliament, and was therefore the first that dismembered this cruel traffic. In the debate which ensued upon it, it was declared in substance, both by lord Grenville and Mr. Fox, in their respective houses, that they would do every thing to effect the abolition, and should they succeed in such a noble work, they would regard their success as entailing more true glory on their administration, and more honour and advantage on the country, than any other measure in which they could be engaged. Conformably with this sentiment, Mr. Fox himself, on the 10th of June, in a speech most luminous and pathetic, followed up the victory which had been just gained, by moving a resolution, "that this house, considering the African slave-trade to be contrary to the principles of humanity, justice, and policy, will, with all practical expedition, take effectual measures for the abolition of it, in such manner and at such a period as may be deemed most adviseable." This motion produced an opposition as before, and an interesting debate. It was supported by sir Ralph Milbank, Mr. Francis, sir Samuel Romilly, Mr. Wilberforce, lord Henry Petty (now marquis of Lansdown), sir John Newport, Mr. Canning, and Mr. William Smith. It was carried by a majority of 114 to 15. Mr. Wilberforce directly moved an address to his majesty, "praying him to direct a negotiation to be entered into, by which foreign powers should be invited to co-operate with his majesty, in measures to be adopted for the abolition of the African slave-trade." This was also carried, but without a division. On the 24th of June, the lords met to consider both the resolution and address. A proposition was directly made in that house (in order to create delay), that counsel and evidence should be heard. This, however, was happily overruled. Lord Grenville then rose up and introduced the subject. His speech was among the master-pieces of eloquence. He was supported in the debate, which followed by the

lord chancellor (Erskine), the bishop of London (Dr. Porteus), the bishop of St. Asaph (Dr. Horsley), earl Grosvenor, earl Stanhope, earl Spencer, earl of Suffolk, and the lords Holland and Ellenborough. The resolution and address were at length both carried, by a majority of 41 to 20. After this a belief was generally prevalent, that the slave-trade would fall in the next session. This occasioned a fear in the abolitionists, lest it should be carried on in the interim, being as it were the last harvest of the merchants, to a tenfold extent, and therefore with tenfold murder and desolation to Africa. It was therefore thought necessary, as the session was about to close, to introduce another bill into parliament, and this as quickly as possible, that no new vessel should be permitted to go to the coast of Africa for slaves. Accordingly a bill to that effect was prepared, and it passed both houses. In the month of October following, after these great and decisive victories, died the right honourable Charles James Fox, one of the noblest champions of this noble cause. He had lived just to put it into a train for final triumph. This triumph, however, he enjoyed in anticipation. The prospect of it soothed his pains, and cheered his spirit in the hours of his sickness. At this melancholy season it became with him a frequent topic of conversation, and the hope of it was perceived to quiver on his lips, in one of the last moments of his life.

The session of 1807 had not long commenced, when the contest was renewed. Lord Grenville judged it expedient, at this particular crisis, to reverse what had been hitherto the order of proceeding, that is, to agitate the question first in the house of lords. On the 2d of January he presented a bill there, which he called an act for the abolition of the African slave-trade. It was very short; he proposed that it should be printed, and that it should then lie on the table for a while, that it might be maturely considered before it was discussed. On the 4th, no less than four counsels were heard against it. On the 5th the debate commenced. Lord Grenville took a brilliant part in it. He was supported by his highness the duke of Gloucester, the bishop of Durham (Dr. Barrington), the earls Moira, Selkirk, and Rosslyn, and the lords Holland, King, and Hood. The bill was at length carried, at four in the morning, by a majority of 100 to 36. On the 10th of February it went to the commons. On the 20th counsel were heard against it there. On the 23d a debate ensued upon it, on the motion of lord viscount Howick (formerly Mr. Grey, and now lord Grey), who urged the commons to confirm it. The other speakers in favour of it were Mr. Roscoe, Mr. Fawkes, Mr. Lushington, the lords Mahon and Milton, sir Samuel Romilly, sir John Doyle, Mr. Wilberforce, and earl Percy; and it was carried by the vast majority of 283 to 16. On the 6th of March the blanks were filled up. It was proposed, first, that no vessel should clear out for slaves from any port within the British dominions, after the 1st of May following, that is, 1807, and that no slave should be landed in the British colonies after the 1st of March 1808. This and almost every other proposition were opposed, but happily without effect. Suffice it to say, that on the 18th the bill, with the blanks filled up, was carried back to the lords; that in consequence of various amendments, it passed and repassed from one house to the other, but always with opposition; that on the 24th it passed both houses; and that on the 25th, at half past eleven in the morning, it received the royal assent. Thus passed, after a twenty years' hard struggle, during which the field had been disputed inch by inch, and won at last by the arms of reason, this magna charta for Africa in Britain, under the administration of lord Grenville and Mr. Fox, an administration which, on account of its noble exertions in behalf of the oppressed

African race, will pass to posterity, living through successive generations, in the love and gratitude of all the most virtuous of mankind. The news of this great event gave uncommon joy throughout the kingdom, and this joy was farther heightened by authentic news just then received from North America, that the government there had passed a similar bill, which was to be observed as a law through the United States.

In France, on the re-establishment of the Bourbon dynasty, it was proposed to abolish the slave-trade at a distant period. Upon the return of Bonaparte from Elba, an order was issued for its immediate abolition; and a decree to the same purpose has been passed since the expulsion of Napoleon, and the restoration of the present reigning monarch.

SLAVE-COAST, in *Geography*, a tract of country in Africa, bordering on the Atlantic, situated between the Gold Coast and Benin, and comprehending the kingdoms of Ardra, Koto, Popo, and Whidah. See each respectively, and also **SLAVE-TRADE**.

The inhabitants resemble those of the Gold Coast in their politics, religion, and manners.

SLAVE-FALLS, a cataract of North America, in Winnipeg river, 100 yards wide and 20 feet in height. N. lat. 50° 6'. W. long. 95° 20'.

SLAVE-INDIANS, Indians of North America, who were driven from their original country by their enemies the Knisteneaux, along the borders of the Unjigah or Peace river, where it assumes from them the name of the Slave river; though the term by no means involves the idea of servitude, but was given to those fugitives as a term of reproach, that denoted more than common savageness.

SLAVE-LAKE, *Great*, a large lake of North America, so called by the Knisteneaux, which derived its name from that of its original inhabitants, who were called slaves. This lake is well known to the Knisteneaux, who are among the inhabitants of the plains on the banks of the Saskatchewan river; for formerly, when they used to make war in this country, they came in their canoes to that lake, and left them there; from whence there is a beaten path all the way to the Forks, or E. branch of this river, which was their war-road. This lake is said to be more than 200 miles in length, and about 12 in breadth. It is supposed to be the same with Hearne's *Athapuscoru*, which see. Bitumen is found on the coast of this lake, in N. lat. 60°, near its discharge by Mackenzie's river, which, flowing from Slave-lake, discharges itself into the North sea, on the banks of which are coal and bitumen, as far north as latitude 66°. N. lat. 61° 20'. W. long. 115°.

SLAVE-LAKE, *Lesser*, a lake of North America, in N. lat. 55° 30'. W. long. 115°, which discharges itself into the Elk river.

SLAVENSK, a town of Russia, in the government of Ekaterinoflav, on the Dnieper; 48 miles S. of Ekaterinoflav. N. lat. 47° 24'. E. long. 34° 44'.

SLAVE-RIVER, a river of North America, being a continuation of Unjigah or Peace river, which discharges itself into the greater Slave-lake. Near that part of the Slave-river, where it first loses the name of Peace river, and along the extreme edge of the adjoining plains, are very strong salt springs, which in the summer concrete and crystallize in great quantities.

SLAUGHTER. See **MANSLAUGHTER**, **HOMICIDE**, **MURDER**, **BUTCHER**, &c.

SLAUGHTER-HOUSE, in *Rural Practice*, the place where neat cattle and other animals are killed for the butcher. In common houses for this purpose, the blood, filth, and other nastiness are left to remain upon the floors; but in those of the improved kind, the floors are laid in such a manner as to have a proper full degree of fall or declination towards the middle

middle parts, where there is a drain made for taking away all such offensive matters, and keeping the houses quite clean and sweet, merely by pumping or throwing water upon the floors of them.

Houses of this sort have usually the dimensions of about twenty-two feet in length by sixteen in width; but they may be constructed in this way to any suitable extent that may be necessary. The drains of slaughter-houses are often connected with pits or reservoirs, by which means large quantities of excellent manure are accumulated.

These houses, likewise, sometimes form parts in the arrangement of farm buildings in large farm-yards.

SLAUGHTER-Skins, a term used by our curriers and leather-dressers for the skins of oxen, or other beasts, when fresh, and covered with the hair: such as they receive them from the slaughter-houses where the butchers slay the carcass.

SLAUGHTER Creek, in *Geography*, a bay of America, on the coast of Maryland, in the Chesapeake.

SLAUGHTERING of Animals, the custom of killing them for the purpose of food. This operation, for the sake of humanity, should constantly be performed in the most sudden and ready manner possible, and not in the lingering, brutal, protracted way which is usually practised by the generality of butchers in this country. See **STRIKING or Pitting Animals**.

SLAVI, SLAVONIA, and SLAVONIANS. See **SCLAVI, SCLAVONIA, and SCLAVONIANS**.

SLAWATICZE, in *Geography*, a town of Lithuania, in the palatinate of Brzesc, near the Bug; 16 miles S. of Brzesc.

SLAWENTITZ, a town of Silesia, in the principality of Oppeln; 24 miles S.E. of Oppeln.

SLAWIETIN, a town of Bohemia, in the circle of Schlan; 12 miles N.W. of Schlan.

SLAWKOW, a town of Austrian Poland, in the palatinate of Cracow; 25 miles N.W. of Cracow.

SLAWKOW. See **AUSTERLITZ and SCHLAKENWALD**.

SLAWONICA. See **ZLABINGS**.

SLEAFORD, or **NEW SLEAFORD**, a market-town in the wapentake of Flaxwell, parts of Kesteven, and county of Lincoln, England, is situated 16 miles S. of Lincoln and 116 N. of London, on a small rivulet called the Sleaf, which rises in the vicinity, and runs to Chapel Hill, where it joins the river Witham. Many Roman coins of the Constantine family have been found here, from which, and other circumstances, Dr. Stukeley conjectures, that this was a Roman town. "We find the distance," he observes, "between Caistor and Lincoln about forty miles, has two towns upon it at proper intervals for lodging: these are Sleaford and Stanfield. The original names of them are irrecoverable silence, but the eternity of the Romans is inherent. It is probable that Alexander, bishop of Lincoln, built his work upon the site of a Roman citadel. Beside, at Sleaford comes in the other Roman road from the fen country by Brig End Caufy, and at the intersection of these two roads the old town stood." The work here alluded to was the castle, which, in Leland's time, was standing, and is thus described by him. "Withoute the towne of Sleaford standith, west-fourth-west, the propre castell of Sleaford, very well mantayned; and it is compassed with a renning streame, cumming by a cut oute of a little feene, lying almoste flatte weste against it. In the gateway be two portcullises, a high towre in the middle of the castelle, but not set upon a hill of raised earth: the vaults of the castle by the ground be fair. The house, or manor place, lately almost new, buildid of stone and timbre, standith southward without the town. The town nor market is of

no price: the ornaments of it is the bishop of Lincoln's castle, and the late lord Husley's house." Since Leland's time, however, Sleaford has become a different place, and is still improving both as to buildings and population. In the return to parliament in the year 1811, the houses are stated to be 385, the inhabitants 1781. The castle has been wholly levelled with the ground, and lord Husley's mansion, at Old Sleaford, is now a farm-house. A weekly market is held on Mondays, and four fairs are held annually.

The church is a handsome, spacious structure, and, from a manuscript found in the parish chest, appears to have been built in the year 1271, by Roger Blunt and Roger Brickham, of Sleaford, merchants. It consists of a chancel, nave, transept, and two aisles; with a tower crowned by a spire, which rises to the height of 144 feet. In the chancel are several monuments to the family of Carr, by one of which a free-school was erected and liberally endowed in the year 1603; and also an hospital for twelve poor men. The manor and estates were conveyed by marriage, with an heiress of the Carr family, to the late earl of Bristol.

At Kyme, about three miles from Sleaford, Leland says, there was in his time "a goodly house and park." Philip de Kyme, in the reign of Henry II., built here a priory for black canons of the order of St. Augustine, to the honour of the Blessed Virgin. Its surrender by a prior and nine canons to Henry VIII. is noticed by Willis.

About seven miles east of Sleaford, is Haverholme priory, the seat of sir Jenison William Gordon, bart. The house and grounds occupy an area of about 300 acres, which constitute an island, formed by two branches of a river. It was given by bishop Alexander, in 1139, to the nuns and canons of the order of St. Gilbert of Sempringham; and at the dissolution was granted to Edward, lord Clinton. The present possessor of Haverholme made numerous additions to the old remains in 1788, and has formed a mansion in a style corresponding with the importance of the place. Beauties of England and Wales, vol. ix. by J. Britton, F.S.A.

SLEAMORE POINT, the southern extremity of the island of Inisherkan, opposite to Baltimore, in the county of Cork, Ireland. N. lat. 51° 24'. W. long. 9° 19'.

SLEASY HOLLAND, a kind of holland thus called, because made in Silesia in Germany; and which, from its lightness, occasions all thin, slight, ill-wrought hollands, to be called *slasy*.

SLEBÉZE, or **SLYBZE**, in *Geography*, a small island in the straits of Sunda. S. lat. 5° 54'. E. long. 105° 24'.

SLECK, in *Rural Economy*, a provincial term applied to the small of pit-coal; also to the black matter of smutty grain.

SLED, in *Agriculture*, provincially a sledge.

SLEDGE, a kind of carriage without wheels, for the conveyance of very weighty things, as huge stones, bells, &c. The sledge for carrying criminals, condemned for high treason, to execution, is called *burdle*.

The Dutch have a kind of sledge, on which they can carry a vessel of any burden by land. It consists of a plank of the length of the keel of a moderate ship, raised a little behind, and hollow in the middle; so that the sides go a little aslope, and are furnished with holes to receive pins, &c. The rest is quite even.

SLEDGE, in *Agriculture*, an implement employed for conveying various articles upon. It is made of two strong pieces of wood framed together.

It is a very useful sort of contrivance for different kinds of work and purposes in farming in different situations of land, but especially those that are rather of a hilly nature; such as the conveying away various sorts of heavy materials,

as those of stones and earthy matters, and in some instances the produce of the land. Sledges also serve the purpose of transporting ploughs and other heavy tools of agriculture to the different fields and other places where they are to be used or employed, being contrived expressly for such uses and intentions. They are a kind of tool, which are made much use of in many of the northern districts of the kingdom, as well as in some of the southern ones.

In the county of Cornwall they employ a sort of sledge or dray, on most farms, for the carriage of their hay, corn, faggot-wood, and many other matters. Their sledges mostly consist of two strong side-pieces of wood, somewhat in the form of a common boat, only more sharply turned upwards at the ends, which have five, six, and sometimes seven cross-bars mortised into each, being shod below with thick rough portions of strong timber, on which the whole slides upon the surface of the ground.

In some cases two, small, low wheels are attached, on which the machine moves. These sledges are drawn either by horses or oxen in the above district, and are found to be handy and convenient in various ways.

SLEDGE is a large smith's hammer, to be used with both hands: of this there are two sorts, the *up-hand sledge*, which is used by under workmen, when the work is not of the largest sort; it is used with both the hands before, and they seldom raise it higher than their head. But the other, which is called the *about-sledge*, and which is used for battering or drawing out the largest work, is held by the handle with both hands, and swung round over their heads, at their arms end, to strike as hard a blow as they can.

SLEDGE, among *Miners*. See DIGGING.

SLEDGES, in *Rope-making*, are frames of oak mortised together, and clamped with iron in different parts. They are from three feet wide, and eight or twelve feet long, to five feet wide and fifteen feet long. The two sides are the length of the sledge, five by seven inches thick, and tied in by oak bars at each end: near the front are two uprights five feet high, mortised into the sides, and supported by two slanting pieces from the upper end. A breast-board nine inches wide, and from three to five inches thick, is fastened with iron pins to the uprights, and contains holes for the hooks to go through, on which the yarn is hung, which being turned by men, is twisted into strands, and then closed and finished into rope. These sledges are loaded to any degree the rope in making may require.

SLEDGE *Island*, in *Geography*, an island in the North Pacific ocean, near the west coast of North America; about 12 miles in circuit. This island is composed of large loose stones, covered with moss and other vegetables, of which there are twenty or thirty different species, mostly in flower. Captain Cook saw neither shrub nor tree, either upon the island or continent. He observed one fox, a few plover, and other small birds, and also some decayed huts constructed partly below the ground. A beaten path was seen from one end of the island to the other, and these circumstances indicated its having been lately visited by some people. A sledge also was found, which gave name to the island: this was such as the Russians in Kamtschatka used to convey goods from one place to another, over the ice or snow. It was 10 feet long, 20 inches broad; it had a kind of rail-work on each side, and was shod with bone. Its construction was admirable, its parts being neatly put together, partly with wooden pins, but principally with tongues or lashings of whale-bone. N. lat. 64° 50'. W. long. 166° 3'.

SLEDINGEN, a town of France, in the department of the Scheld; 5 miles N. of Ghent.

SLEEAN, in *Rural Economy*, provincially the smut in corn.

SLEEP, in *Physiology*, the more or less complete suspension of the functions of sensation and volition, that is, of the action of the five senses, of the brain, of the voluntary muscles, and the voice, or the organs which connect us with the external world, to which animals, at least those of the classes mammalia and birds, are subject at certain more or less regular intervals, for the purpose of renewing the power of action exhausted by exercise.

In the article LIFE we have stated, that the internal functions, which make up the *organic* life, differ remarkably from the external, which compose the *animal* life, in the duration of their action; that while the former go on incessantly, the latter are subject to intermissions or periods of complete repose, each particular organ experiencing, from its activity, an exhaustion of power, a fatigue, which renders rest absolutely necessary before it can be again exerted; which exhaustion or fatigue is unknown in the organic life. This law, of the intermission of action, has been very satisfactorily applied by Bichat to the theory of sleep. "General sleep," says he, "is the assemblage of particular sleeps. It is derived from that law of the animal life, which causes in its functions a constant succession of periods of activity, and times of intermission;—a law, which pointedly distinguishes it from the organic life. Hence sleep influences the latter only in an indirect way, while it exerts its full operation on the former.

"Numerous varieties may be remarked in this periodic state, to which all animals are exposed. The most complete sleep is that, in which the whole external life, that is, the senses, perception, imagination, memory, judgment, locomotion, and the voice, are suspended; the least perfect affects only a single organ. We see numerous gradations between these two extremes; sometimes the senses, perception, locomotion, and the voice, are suspended; imagination, memory, and judgment remaining active; sometimes locomotion and the voice are added to the latter. Such is the sleep which is agitated by dreams. A portion of the animal life still continues active, having escaped the torpidity in which the rest is plunged. Three or four senses only may have passed into the state of repose, and ceased to be influenced by external objects; then that kind of somnambulism occurs, in which, to the action of the brain, the muscles, and the larynx, are added those of hearing and touch, often in a very distinct form.

"Let us then no longer regard sleep as a constant state, invariable in its phenomena. Scarcely do we sleep twice together in the same way; a multitude of causes modifies this condition of our being, by applying to a greater or smaller portion of the animal life the general law of intermittent action. The various modifications must be characterized by the functions, which are affected in different instances. The principle is the same throughout, from the simple relaxation, which follows the contraction of a voluntary muscle, to the entire suspension of the animal life. Sleep is in all cases a consequence of that general law of intermission, which exclusively characterises this life, but the application of which to the various external functions varies infinitely.

"This explanation of sleep is undoubtedly very different from those narrow systems, which place its cause in the brain, the heart, the large vessels, the stomach, &c. and thus present an insulated phenomenon, often illusory, as the basis of one of the great modifications of life.

"Why do light and darkness, in the natural order of things, correspond respectively to the activity and repose of the

the external functions? Because, during the day, the animal is surrounded with a multitude of exciting causes; a thousand things exhaust the powers of the sentient and locomotive organs, fatigue them, and thus prepare a relaxation, which is favoured at night by the absence of all stimuli. Thus, in the modern way of life, in which this order is partly inverted, we assemble round us, during the night, various stimuli, which prolong the state of watchfulness, and make the intermission of the animal life coincide with the first hours of the dawn, favouring it by removing all circumstances that might produce sensations.

“By multiplying around them causes of excitation, we can, for a certain time, prevent the organs of the animal life from obeying the law of intermission; but they yield at last, and nothing, after a certain time, can suspend its influence. Exhausted by continued exertion, the soldier sleeps at the side of the cannon, and the criminal even amid the tortures of the question.

“Let us, however, distinguish natural sleep, the consequence of fatigue of the organs, from that which is caused by affections of the brain, as apoplexy, or concussion. In the latter case the senses are awake, they receive impressions, and are affected by them as usual; but these impressions cannot be perceived by the disordered brain, and we consequently are not conscious of them. In sleep, on the contrary, the intermission of action affects the senses as much, and even more than the brain.” *Recherches Physiol. sur la Vie et la Mort*, p. 34—37.

Although the remarks of Bichat in the preceding quotation, respecting the sleep of the particular senses, may be regarded rather as illustrations, than as proofs that the state of fatigue from exertion of any particular organ is exactly the same as its condition in sleep, we consider the general view of the subject as perfectly correct. In the most complete sleep, our relations to external objects are entirely suspended, and consciousness undergoes an equally complete interruption. The appropriate stimuli, presented to the external senses, excite no sensations; the operations of the mind do not go on; hence there is nothing to excite volition, and the voluntary powers are consequently quiescent. The portion of existence passed in such sleep is a perfect blank. We have examples of it in the most tranquil and healthy states of the body and mind, and after considerable fatigue, or in the recovery from severe and painful disease.

But this sound sleep is much less common, than that which is more or less interrupted by dreams, in which a series of sensations, perceptions, and reflections, passes through the mind, as in the waking state. We are conscious of the same kind of transactions as occupy our waking hours; we see, hear, walk, talk, and perform all the customary offices of life. The mind reasons, judges, performs volition, and experiences the various affections, as love, hatred, indignation, anxiety, fear, joy, even in a much more lively degree, than when they are excited by their real causes. In dreaming, as in the soundest sleep, the action of the external senses is suspended; but the internal faculties are active in greater or less number. Volition takes place, but the muscles do not obey the will. That dreaming is a less sound species of sleep, appears from the familiar fact, which has probably been observed by every individual; *viz.* that the first sleep is much freer from it than the second. We retire to rest, fatigued by the exertions of the day, and sleep soundly for five or six hours: we wake, and then fall asleep again towards the morning, and dream the whole time of this second sleep.

Haller, who mentions that he had attended much to his

dreams, observes, that in perfect health he remembered only the sensation of flying through the air, conceiving himself suspended above the earth and carried to a distance.

The order of the images and reflections, which pass through our minds in sleep, and the laws of their succession and connections, are the same as when we are awake. We must observe, however, that these internal processes now go on by themselves, and are not corrected by that reference to external objects, and that exercise of the external senses, which takes place in the waking state. Thus we see a friend long dead, without being aware that he is not alive; and gross inconsistencies and absurdities take place without being remarked.

The great activity of the imagination and judgment in the act of dreaming, is evident from the nature of many dreams. “Often,” says Haller, “in my dreams, I seem to read books, printed poems, histories of travels, &c.; and I even see the plants of distant regions, suited to their climates.” Others solve problems, write, make verses, &c. The reasonings which are carried on in sleep, the speeches which are made, &c. are often more quickly and easily performed than when we are awake.

The causes of dreams are very obscure; we cannot determine how the intellectual powers are called into exercise, nor what stimuli should be applied for that purpose. It is known, however, that various bodily derangements have an important influence. The state of the stomach, which so often acts on the brain, will frequently disturb our rest; if a person, unaccustomed to such indulgence, eat a hearty supper, he will experience nightmare, that is, a sense of pressure about the chest, and of some most dreadful impending danger, without the possibility of escaping it. When the painful sensation is arrived at its height, we awake, and can immediately move. Or the same cause, instead of producing nightmare, may distress us with terrific dreams, in which dangers assail us in every shape: we fancy that we cannot escape from the intricate passages and rooms of a house; that we shall fall from a precipice, or into a river. In these instances, too, some very strong impression generally rouses us in a state of great alarm. Instances are not wanting of persons who have determined to remember that the dangers presented to the mind in dreaming are fallacious, and have recollected this at the time, so as to be protected from the alarm, which would otherwise have been caused. Professor Stewart mentions that Dr. Reid freed himself in this way from the distress of frightful dreams, which had annoyed him for some time. The writer of this article has experienced the same circumstance, and Haller mentions a similar fact: “*Ita ille, quem diximus, ad vitandas pollutiones voluntatem firmam attulisse, expurgiscebatur ad sensum lubricæ imaginis.*”

In many bodily disorders, broken sleep, and alarming dreams, which make the patient start and awake, are common symptoms; such is the case in hydrothorax, and diseases of the heart. The delirium of fever is an unnatural activity of the internal faculties, the senses being more or less quiescent, produced by the excitation of the brain, and not differing in its essential nature from dreams.

Immediate impressions sometimes influence us during sleep; children will evacuate their urine on a chamber-pot being put in their hands; and the same effect is said to have been produced by putting the hand of a sleeping child in cold water. The cause acts more powerfully than it would in the waking state; and the same remark holds good with respect to the excretion of the seminal secretion in sleep. “*Somnum,*” says Haller, “*quam sensatio fortius est, et vehementius animam percellit. Id tribuas solitudini, quieti, adtentioni ad unicum objectum. Certe vix unquam sanus homo ex quacunque*

cunque libidine semen profuderit. In fomiis id fit, certa quidem ætate, neque fere in senis, perfacile in pueris. Sed neque fenatio, quæ fomni causa est, aut sola aut pura menti representatur. Ex lege associationis idearum ad simplicem stimulum nascitur idea femine pulchræ, amatæ, quam ambias, quæ cedat facilis: accedit lectulus, et omne satellitium arcani amoris. Et magis et magis post primos sermones adpropinquat comicus sperata voluptas, ut vicissim perinde anxietatis hieroglyphæ continuo graviora menti incumbunt.”

The dreams which occur almost nightly in most individuals, shew the activity of the internal mental operations during sleep: voluntary motions are less commonly performed. Some horses sleep standing; and the lower jaw is maintained elevated in us during sleep. The hand is often raised when any stimulus is applied to the body, although it may not be strong enough to interrupt sleep. The fact of children expelling their urine, when the pot is brought to them, has been already noticed. Many persons laugh, weep, sigh, and talk in their sleep: the words are indeed generally indistinctly pronounced, and the sentences incomplete.

The sleep-walkers differ from these only in degree. They execute the voluntary motions, which arise out of the mental processes carried on in sleep. It would be endless to recount the particular cases belonging to this subject. It is sufficient to mention that individuals rise from bed asleep, and with their eyes closed, and not only walk about the room or house, going up or down stairs, finding their way readily, and avoiding obstacles, but pass safely through very dangerous places, as windows, or on the roofs of houses. They execute, too, still more difficult feats. They dress themselves, go out of doors, light a fire, undress and bathe, saddle and bridle a horse, ride, write, make verses, and execute all the actions of life correctly, and even sometimes acutely. During this time they are asleep; the eyes are shut, or do not see if open; the iris is not irritable. When awakened, which is sometimes not easily effected, they do not remember what they have done.

The proportion of time passed in sleep differs in different individuals, and at different ages. From six to nine hours may be reckoned about the average proportion. Men of active minds, whose attention is engaged in a series of interesting employments, sleep much less than the listless and indolent; and the same individual will spend fewer hours in this way, when strongly interested in any pursuits, than when the stream of life is gentle and undisturbed. The great Frederic of Prussia, and John Hunter, who devoted every moment of their time to the most active employments of body and mind, generally took only four or five hours sleep. A rich and lazy citizen, whose life is merely a chronicle of breakfasts, dinners, suppers, and sleep, will slumber away ten or twelve hours daily. When any subject strongly occupies us, it keeps us awake in spite of ourselves. These phenomena are consistent with what we have already said; the animal organs, when the period of their intermission and repose has arrived, are kept in activity by new and unusual causes of excitation, and thus the ordinary period of sleep may be passed over, and its ordinary quantity much diminished. When a person, who has thus been kept long awake by the occupation of his mind with important and urgent subjects, at last falls asleep, the slightest irritation calls up in the fancy all the trains of thought which have just occupied us, and sets at work again all the internal machinery which has hardly yet become quiet; the sleep, under such circumstances, is imperfect, and much disturbed by dreaming.

The newly-born child sleeps most of its time; it seems to

wake merely for the purpose of feeding. Some have called fatal existence a perpetual sleep; but the animal organs, never having been yet exercised, can hardly be said to be in a state of repose. See EMBRYO.

For the first two or three years, children sleep more than once in the twenty-four hours. Again; very old persons sleep much of their time: in the natural progress towards death, the animal faculties are first extinguished; accordingly, when they begin to decline in decrepid old age, the periods of their intermission are longer. The celebrated De Moivre, when eighty-three years old, was awake only four hours out of the twenty-four (Hist. de l'Acad. des Sc. for 1754); and Thomas Parr at last slept the greatest part of his time. Animals which do not prey by night, seem to pass as much time asleep as awake; that is, they sleep during the dark, and are awake so long as the sun is above the horizon.

The state of torpidity in which many animals pass the winter months, cannot properly be called sleep; it is not a repose of the animal organs, consequent on the fatigue produced by their exercise; but is a peculiar condition of the whole frame, affecting the internal as well as the external organs, and caused directly by the action of cold.

The exhaustion of the powers of the animal organs by exercise being the determining cause of sleep, it comes on after the close of our daily occupations, when darkness necessarily causes an intermission of labour and a general quiet, which are favourable to repose. The number of hours devoted to active occupation, and the time at which disposition to sleep is felt, are influenced considerably by habit: after considerable and unusual exertion, sleepiness will be felt in the day-time.

The period of sleep may be protracted, by unusual excitation, much beyond the ordinary period; but the effect is lost after a certain time, and sleep comes on under circumstances, which appear at first most unfavourable to it. An eye-witness reported that some boys, completely exhausted by exertion, fell asleep amid all the tumult of the battle of the Nile; and other instances are known of soldiers sleeping amid discharges of artillery, and all the tumult of war. Couriers are known to sleep on horseback, and coachmen on their coaches. A gentleman who saw the fact, reported to the writer of this article, that many soldiers in the retreat of sir John Moore, fell asleep on the march, and continued walking on. Even stripes and tortures cannot keep off sleep beyond a certain time; but it then indicates the greatest exhaustion, and consequently affords an unfavourable prognosis. Noises at first prevent us from sleeping, but their influence soon ceases, and persons rest soundly in the most noisy situations. The proprietor of some vast iron-works, who slept close to them, through the incessant din of hammers, forges, and blast-furnaces, would awake if there was any interruption during the night. And a miller, being very ill and unable to sleep, when his mill was stopped on this account, rested well and recovered quickly when the mill was set a going again.

Great hunger prevents sleep; and cold affecting a part of the body has the same effect. These causes operated on the unfortunate woman who lived thirty-four days in a small room overwhelmed by snow, and with the slightest sustenance: they hardly slept the whole time. (Somis Ragionamento sopra un fatto avvenuto in Bergemolletto, &c. p. 74.) Indigestion, and various bodily affections, produce sleeplessness. We have already noticed, that all mental occupations attended with intense thought, and great interest, prevent sleep; and any great affections of the mind have the same effect.

It will easily be understood that circumstances opposite to those just enumerated are favourable to sleep. Bodily exercise with tranquillity of mind, and absence of all excitation, are the most important of these. A full repast is often followed by sleep, even in animals, as dogs. The distention of the stomach excites the circulation, and thus brings on a condition of the brain favourable to sleep. Various vegetable substances taken into the stomach act on the brain in the same way. Intense cold, affecting the whole body, exhausts the animal powers and brings on sleep, which is speedily fatal. See COLD.

Sleepiness, when it occurs naturally, after our daily occupations, is marked, first, by a sense of muscular fatigue, particularly in the long muscles: it may be experienced in various parts, according as they have been more exercised. We begin to gape; the intellectual functions languish; curiosity is blunted; attention becomes painful; and a great desire of repose is felt over the whole body. The impressions on the external senses are indistinct; we cannot read well, nor does the memory act with its usual force or order: an uneasy sensation is perceived in the eye; the upper eye-lid falls in spite of every effort to keep it elevated. Now the muscles of the whole body are more or less relaxed: hence the head inclines forwards, and the whole body would come to the ground if the person were standing. The sense of hearing seems to be suspended last; we hear and understand the conversation of those near us, when the eyes no longer act. Now the succession of our mental operations becomes quite involuntary; and a kind of delirium takes place, in which the trains of thought preserved in the memory succeed according to their natural associations and connections. These operations are then suspended, and sleep is complete.

Respecting the state of the body in sleep we have very little to add to our general account already given. In complete sleep the body is perfectly motionless; the senses are not affected by their respective external objects, unless the impressions should be strong enough to arouse us. Hunger and thirst are not felt; nor are we conscious of the necessity of emptying the bladder or bowels, until the distention is sufficient to waken us. The functions of the organic life go on uninterruptedly; digestion, chylification, and the conversion into feces, absorption, circulation, respiration, nutrition, secretion, are all continued. There may be some slight modifications, but they are unimportant.

After the sleep has lasted long enough to restore the animal powers, we awake, without any change or occurrence which can be shewn to affect particularly the brain or other parts, of which the action was suspended by sleep. We open our eyes, and often rub them. We move the limbs and stretch them; and in a few seconds we have the full use of our senses, intellectual faculties, voice and voluntary muscles, and they recover their powers of action completely.

There are rare examples of individuals, who have gone on sleeping for days, weeks, and months; but these histories are not accompanied with such particulars as would enable us to judge of the cause for such a deviation from the ordinary course of nature.

SLEEP, *Somnus*, in *Mythology*, the son of Erebus and of Night, according to Homer and Hesiod, and the brother of *Mors* or *Death*.

Virgil (*Æn.* vi. v. 278.) assigns to this deity an abode with death, in the subterraneous or invisible world.

Statius and Ovid place the chief residence, or great palace of *Somnus* on our earth, in the country of the *Cimmerians*; no country agreeing better with sleep than that which is

overspread with eternal darkness. *Theb.* x. v. 84 to 117. *Met.* xi. v. 592 to 645.

Dreams were the children of sleep; Ovid names three of them, *viz.* *Morpheus*, *Phobetor*, and *Phantasia*.

This deity is most commonly represented by the artists as a soft youth, stretched at his ease on a couch, resting his head on a lion's skin, and sometimes on a lion; with one arm either a little over or under his head, and the other dropping negligently by the side of the couch, and either holding poppies, or a horn with the juice of poppies in it. He is often winged, and much resembles a little Cupid, from whom he is distinguished by the lizard (an animal supposed to sleep half the year) placed at his feet. There is scarcely any one of the deities that is more fully and particularly described by the poets than this deity of sleep. *Spence's Polymetis*, p. 263, &c.

SLEEP of *Plants*, *Somnus Plantarum*, in *Vegetable Physiology*, is a term used by Linnæus, to express a peculiar state in the constitution of many plants during the night, evinced by a change of position, generally a drooping, or a folding together, of their leaves or leaflets. Such a change, being occasioned by the withdrawing of the stimulus of light, is probably a state of rest to their vital functions, and therefore the above term is not so hyperbolic as at first appears. Linnæus has given a curious treatise on this subject, in the *Amenitates Academice*, v. 4. 333. The phenomenon itself had been noticed long before, by Acofta and Prosper Alpinus, in the Tamarind-tree; and the latter points out several parallel instances in other leguminous plants with pinnated leaves, natives of Egypt. It is indeed most remarkable in such plants. Herbs with ternate leaves, as the Trefoil and *Oxalis*, sleep with their leaflets folded together in an erect posture; and Pliny has observed that the former of these assumes that position at the approach of storms. Cloudy weather, no doubt, produces this effect, in proportion as the plant is in vigour, and the stimulus of preceding sunshine has been strong. Not that a cessation or diminution of heat appears to cause the change alluded to; for Linnæus has well remarked, from observing stove-plants, that such is not the case. It is the withdrawing of a considerable portion of light. The more young and tender the plant, the more sensibly is it affected by this cause.

Linnæus has, in the above-mentioned treatise, elaborately described the various positions which the leaves of different plants assume in their sleep. In general, it may be remarked that they cover, or fold together, the upper surfaces of their leaves, exposing the under, which latter is almost uniformly impatient of light. This is so much the case, that we cannot but suspect the effect of the returning light upon the backs of such leaves, may be the immediate cause of their withdrawing from it, and thus the upper surface becomes necessarily presented to its rays.

A similar effect of light is seen in many flowers, particularly of the compound tribe. But the expansion of these is regulated by other and more abstruse laws, which often limit their changes to certain hours of the day, partly, though not absolutely, independently of light. Many of the *Campion* tribe, especially, unroll their delicate petals in an evening only, in a precise and determinate manner, not to be attributed either to the presence or the absence of light. So the moving-plant, *Hedysarum gyrans*, performs its curious gyrations with apparently perfect indifference as to the degree of light to which it is exposed, provided the surrounding atmosphere be warm and still. The closing or drooping of flowers, moreover, when it depends only on the diminution of light, generally answers an evident secondary purpose, in sheltering the organs of impregnation from the injurious

SLEEP.

injurious effects of rain, or nocturnal dews. But such is seldom the case with leaves, except incidentally, as in *Lotus ornithopodioides*, which plant first led Linnæus to attend particularly to the subject before us.

SLEEP of the Soul, in Theology, denotes that insensible, unconscious, and inactive state, into which some have supposed that mankind are removed at death, and in which they remain till the period of the general resurrection and last judgment. The term sleep has been used by way of contradistinction to that which has been commonly called the intermediate or separate state. Of the advocates of this opinion, some have allowed the essential distinction between body and spirit, and the natural immortality of the human soul; so that, being a substance and not a mode, it will go on to exist, till by some positive act of the Creator it is annihilated. They cannot admit the supposition, that the whole man becomes extinct at death, or that death destroys or annihilates the thinking substance; because, they say, the resurrection on this hypothesis, will not be a resurrection, but a creation of a new set of beings: if death annihilates us in this sense, there can be no future state; because, a being who has lost his existence cannot be recovered. Accordingly, they maintain, that what happens to the soul at death can be no more than a suspension of the exercise of its faculties, or an incapacitation, from which it will, by the power of Christ, be delivered at the resurrection: and they allege, that there is an infinite difference between the annihilation of the soul at death, and its incapacitation; because, one who believes the former, could not possibly entertain the hope of a future state; but one who believes the latter, might reasonably entertain such a hope. Death, they say, is a distress in which our species has been involved by extraordinary causes, and from which we have obtained the hope of being saved by the most extraordinary means, viz. by the interposition of Jesus Christ, who, taking upon him our nature, and humbling himself to death, has acquired the power of destroying death, and is on this account styled the Saviour of the world. However, most of those who deny the notion of an intermediate state of conscious perception between death and the general resurrection, reject the supposition of two distinct natures in man, and consider that principle, which is called the *soul*, not as a spiritual substance, but as a quality, or property, either superadded to matter by the creator of our frame, or resulting from the organization of the human body, and particularly of the brain. See SOUL.

Accordingly, they allege, that when the organized system, to which the power of thinking, &c. is annexed, on which it depends, and from the organization of which, as some maintain, it necessarily results, is dissolved by death; all the percipient and thinking powers of man, all his capacities of action, and of suffering, or of enjoyment, must be extinguished, and cease of course. And if the property of thinking necessarily attends the property of life, as some apprehend, nothing can be requisite to the restoration of all the powers of the man, but the restoration of the body (no particle of which can be lost) to a state of life. Whatever is decomposed, it is said, may certainly be recomposed by the same Almighty power that first composed it, with whatever change in its constitution, advantageous or disadvantageous, he shall think proper; and then the powers of thinking, and whatever depended upon them, will return of course, and the man will be, in the most proper sense, the same being that he was before. Those who hold this opinion maintain, that, according to the scriptures, life and immortality were brought to light by the gospel of Christ, in a sense exclusive of all other teachers,

and all other revelations, at least from the birth of Moses downwards; exclusive, likewise, of all information from the light of nature, or the result of philosophical disquisition on the substance or qualities of the human soul. They hold, moreover, that the sentence pronounced upon our first parents, imported a total deprivation of life, without any reserve, or saving to the life of the soul; and consequently, that eternal life, or a restoration and redemption from the consequences of this sentence, was effected for, revealed, consigned, and insured to man, in and through Christ, and will be accomplished in no other way than that spoken of by Christ and his apostles, who, they say, have left no room to conclude, that there is a separate or intermediate life for the soul, when disunited from the body.

The learned Dr. Law, bishop of Carlisle, having, with a particular view to the controversy concerning the intermediate state, enumerated the several passages both in the Old and New Testament, in which the words, that are translated soul or spirit in our version, occur, maintains, that none of them ever stand for a purely immaterial principle in man, or a substance wholly separable from, and independent of, the body; and after examining the account which the scriptures give of that state to which death reduces us, he observes, that it is represented by sleep, by a negation of all life, thought, or action; by rest, resting-place, or home, silence, oblivion, darkness, destruction, or corruption. He adds, that the scripture, in speaking of the connection between our present and future being, doth not take into account our intermediate state in death; no more than we, in describing the course of any man's actions, take in the time he sleeps: and that, therefore, the scriptures, in order to be consistent with themselves, must affirm an immediate connection between death and judgment. As for those texts that are usually alleged on the other side of the question, which he has cited and endeavoured to accommodate to his own opinion, he thinks that they are quite foreign to the point, or purely figurative, or capable of a clear and easy solution on the principle which he adopts, viz. that the times of our death and resurrection are coincident; and that they cannot be fairly opposed to the constant, obvious tenor of the sacred writings. With respect to philosophical arguments, deduced from our notions of matter, and urged against the possibility of life, thought, and agency, being so connected with some portions of it as to constitute a compound being or person, he imagines that they are merely grounded on our ignorance, and that they will equally prove against known fact and observation, in the production of various animals, as against the union of two such heterogeneous principles as those of the soul and body are supposed to be. With respect to the consequences of either opinion, he says, that on the one side, there is nothing more than a temporary cessation of thought, which can hurt nobody, except the self-interested papist, or the self-sufficient deist; but on the other side, there is a manifest derogation from, if not a total subversion of, that positive covenant, which professes to entitle us to everlasting life. He adds, that all proper and consistent notions of death, resurrection, and a future judgment, are confounded, and in fine, all the great sanctions of the gospel rendered unintelligible or useless.

The doctrine of the New Testament, says another writer against a separate state, is that man shall become immortal, by the way of a resurrection of the dead, a restoration of the whole man to life; and the New Testament is so far from acknowledging any intermediate consciousness in man, between death and the resurrection, that it always speaks of that interval as a sleep, which implies a suspension of

the thinking faculty, a rest from those labours, which require thought, memory, consciousness, &c. during which those faculties are useless.

Besides, the scriptural system of immortality supposes, that man had forfeited his original title to immortality, and would never have received it, but for the interposition of a Redeemer. The consequence of this doctrine is, that between the time of the forfeiture and the actual appearance of the Redeemer, the dead could have life in no sense at all; and that neither before nor after the appearance of the Redeemer, dead men were, or would be restored to life, otherwise than in the way revealed by him, namely, a resurrection of the dead.

On the other hand, the advocates of a separate state insist, that the soul, being an active, simple, un compounded, immaterial substance, is immortal in its own nature, and capable of an active and conscious existence, in a state of disunion and separation from the body; that this natural capacity of the soul was not impaired, or at all affected by any thing that happened upon the transgression of our first parents; that the death, to which they were condemned, was only the death of the body: hence they infer, that there is, and would have been, a future immortal state of being beyond the present life, and (the moral attributes of God presupposed) a just retribution therein, independent of the doctrine of a resurrection of the dead; and that in the interval between death and the general resurrection, there is an intermediate state, in which the departed souls of good men are supposed to have an imperfect reward, and the souls of the wicked an imperfect punishment; but that every one, at the period of the reunion of the soul and body, and of final judgment, will receive a full and complete recompense for the deeds done in the body.

In proof of this opinion, they allege a variety of passages both from the Old and New Testament, the principal of which we shall here enumerate; several of which they think cannot be consistently explained on the other hypothesis. Gen. ii. 7. xv. 15. xxxvii. 35. Exod. iii. 6. 1 Sam. xxviii. 11—19. 1 Kings, xvii. 21, 22. Ps. xxxi. 5. Eccles. iii. 21. xii. 7. Matt. x. 28. xvii. 3. Luke, xvi. 19. xx. 38. xxiii. 43. xxiv. 39. Acts, i. 25. vii. 59. 2 Cor. v. 8. xii. 2. Phil. i. 21—24. 1 Pet. iii. 19. iv. 6. Heb. xi. 40. xii. 23. Rev. vi. 9, 10. xiv. 13.

To these authorities of scripture, they add the testimony of the fathers of the church, who lived in or near the time of the apostles, who are said to be unanimous in this opinion, and persuaded that the soul of every man upon the dissolution of the body died not, but had a proper place to go to, and that accordingly this doctrine is to be found in the most ancient Christian liturgies.

Great stress has been laid, in this controversy, on the meaning of the term death, as it occurs in scripture, and particularly in the sentence denounced against the first parent of the human race. (See DEATH, in *Theology*.) The bishop of Carlisle observes, that the word *death*, in its original and obvious sense, implies a cessation of all natural life, or a real dissolution and destruction of the whole man. But Mr. Farmer, a well-known and excellent writer, in the introduction to his learned work of the "General Prevalence of the Worship of Human Spirits, &c." 1783, has taken some pains to ascertain the meaning of the word *death*, in the threatening denounced against Adam. To this purpose, he says, that if human spirits were worshipped in the age of Moses, particularly in Egypt and Phœnicia, the word death could not at that time, and in those countries, denote more than the destruction of bodily life; for, if this term had farther included in it the insensibility or

extinction of the soul, the dead would not have been honoured as gods. And if Moses had used it in this extensive sense, he would have been misunderstood by the Egyptians, who asserted the immortality of the soul, and by the Hebrews, who dwelt among them, and had adopted their system of religion.

This learned writer, in confirmation of this interpretation of death, observes, that although one great design of Moses, in giving an account of the introduction of death into the world, was to guard against the worship of departed spirits, and though nothing could have answered this design more effectually than representing the soul of Adam as a mere quality, or as the result of the peculiar structure and organization of his body, yet, so far is he from supposing this to be the case, that according to him, after the body of the first man was perfectly organized by the immediate hand of the Almighty, he did not become a living soul or person, till God breathed into his nostrils the breath of life; a principle distinct from the dust out of which his body was formed, and, therefore, capable of subsisting in a state of separation from it. Nor does Moses use the same language in relating the formation of any other living creatures; which proves that the principle of life in man is of a superior kind to that in brutes.

Besides, the ancient patriarchs did not believe that the soul of man perished with his body. Agreeably to the most ancient opinion concerning departed spirits, the sacred writers supposed the souls of the dead to exist in *sheol*, or *hades*, a place invisible to human sight, and that, in the distribution of them, regard was had to the former relation in which they stood to one another. Moreover, Moses himself believed the separate subsistence of the soul, and has even given it a divine sanction. Gen. xv. 15.

Nor do any of the sacred writers ever describe death in terms different from those used by persons, who certainly acknowledged the continuance of the soul after it.

Sleep, by which it is described, is not a state of non-existence, but of rest; and it is well known, that this soft image of death was commonly used to express the thing itself, by those who asserted the existence of souls in *hades*. Silence, oblivion, darkness, and corruption, by which the state of the dead is described, refer only to the body, or to the supposed state of the soul, while it was in *sheol*, and are not peculiar to the sacred writers, but were common in all countries, where both the popular belief, and the established worship, were inconsistent with the notion of the soul's perishing with the body.

And many of the terms, by which death was described in all countries, clearly imply, and are built upon, a belief of the distinction between soul and body, and of their being separated at death.

According to the Greeks, to die was to depart, to go away; and the writers of the New Testament describe death by a departure, (Luke, ix. 31.) that is, of the soul from the body to another state. To all which it may be added, that the Jews, from the time of their return from Babylon, asserted the separate existence of the soul after death; as appears from their imitation of the heathen idolatry, from their evocation of the dead, and from the early references in scripture to the receptacle of departed souls, and many other proofs. This was the opinion, not only of a few eminent individuals, such as Philo, but of the learned sects, the Essenes and Pharisees, and of the whole body of the people, almost without exception, in the time of our Saviour. To this principle the Pharisees, whose doctrine formed the popular creed, added another, *viz.* the resurrection of the dead. The Sadducees believed the extinc-

tion of the soul at death, but did not admit the resurrection; the Pharisees, on the other hand, admitted the latter and denied the former. By the term reviviscence, or return to life, by which the resurrection is described, the Jews could not mean creating anew the soul, that had been destroyed, because, if it were possible, they did not allow that the former soul perished at death. Nor did they believe, that man had no soul; and, therefore, that his resurrection consisted in the re-organization of his former body, or in furnishing him with a new body, organized as that was; because this is a flat contradiction to their belief of the distinction between soul and body, and the separate existence of the former. What then did they, or could they mean by the resurrection to life, but the restoration of that kind of life which they had lost, by the reunion of their souls to a human body, either the same which they had before, or one in effect the same? In virtue of this reunion, the *dead* man became a *living* man, the same as he was before he died, with the same consciousness and recollection, the principle of consciousness having never perished. And if, in or near the time of Christ, the terms resurrection, reviviscence, or living again, as used both by Jews and Gentiles, denoted the reunion of a soul to a human body, the same terms, when adopted by Christ and his apostles, must have the same meaning; and every one would understand them in their common and ordinary signification. Consequently, if life, as expressing the resurrection, signifies the soul's return to a human body, death, its opposite, denotes its separation; both terms imply the continuance of the soul after death: a principle, says Mr. Farmer, held in the most ancient times, by Heathens and Jews, by patriarchs and prophets, and by the people, particularly in the times of Moses and the Messiah, and which gives great probability to the doctrine of a resurrection.

The advocates of the sleep of the soul, on the other hand, earnestly contend, that it was the opinion of the apostles and early Christians, that, whatever be the nature of the soul, its percipient and thinking powers cease at death; and that they had no hope of the restoration of those powers, but in the general resurrection of the dead.

Dr. Campbell, in his "Preliminary Dissertations," (Part ii.) has introduced some remarks, that deserve attention, on the controversy concerning an intermediate state between death and the resurrection. He observes, *first*, that the arguments, on which the deniers of that state chiefly build, arise, in his opinion, from a misapprehension of the import of some scriptural expressions. *Καθευδων, κοιμων, to sleep*, are often applied to the *dead*; but this application is no more than a metaphorical euphemism, derived from the resemblance which a dead body bears to the body of a person asleep. Traces of this idiom may be found in all languages, whatever be the popular belief about the state of the dead. They often occur in the Old Testament; yet it has been shewn, that the common doctrine of the Orientals favoured the separate existence of the souls of the deceased. But if it did not, and if, as some suppose, the ancient Jews were, on all articles relating to another life, no better than Sadducees, this shews the more strongly, that such metaphors, so frequent in their writings, could be derived solely from bodily likeness, and having no reference to a resurrection, could be employed solely for the sake of avoiding a disagreeable or ominous word. It is acknowledged, at the same time, that Christians have been the more ready to adopt such expressions, as their doctrine of the resurrection of the body, presented to their minds an additional analogy between the bodies of the deceased and the bodies of those asleep, that of being one day awakened.

But our author fees no reason to imagine that, in this use, they carried their thoughts further than to the corporeal and visible resemblance now mentioned. Another mistake about the import of scriptural terms, is in the sense which has been given to the word *ανασηαις*. They confine it, by a use derived merely from modern European tongues, to that renovation which we call the reunion of the soul and the body, and which is to take place at the last day. But this is not always the sense of the term in the New Testament.

Dr. Campbell remarks, *secondly*, that many expressions of scripture, in the natural and obvious sense, imply that an intermediate and separate state of the soul is actually to succeed death. Such are the words of our Lord to the penitent thief upon the cross (Luke, xxiii. 43.); Stephen's dying petition (Acts, vii. 59.); the comparisons which the apostle Paul makes in different places (2 Cor. v. 6, &c. Philip. i. 21.) between the enjoyment which true Christians can obtain by their continuance in this world, and that on which they enter at their departure out of it, and several other passages. Let the words referred to be read by any judicious person, either in the original, or in the common translation, which is sufficiently exact for this purpose, and let him, setting aside all theory or system, say candidly, whether they would not be understood, by the gross of mankind, as presupposing that the soul may and will exist separately from the body, and be susceptible of happiness or misery in that state. If any thing could add to the native evidence of the expressions, it would be the unnatural meaning that is put upon them, in order to disguise that evidence. The apostle Paul, they are sensible, speaks of the saints as admitted to enjoyment in the presence of God, immediately after death. Nevertheless, in order to palliate the direct contradiction this bears to their doctrine, that the vital principle, which is all they mean by the soul, remains extinguished between death and the resurrection, they remind us of the difference between absolute or real, and relative or apparent, time. They admit that, if the apostle be understood as speaking of real time, what is said flatly contradicts their system: but they say, his words must be interpreted as spoken only of apparent time. He talks indeed of entering on a state of enjoyment, immediately after death, though there may be many thousands of years between the one and the other: for he means only, that when that state shall commence, however distant in reality the time may be, the person entering on it will not be sensible of that distance, and consequently there will be to him an apparent coincidence with the moment of his death. But, says Campbell, does the apostle any where give a hint that this is his meaning? or, is it what any man would naturally discover from his words? Did the sacred penman, then, as our author proceeds, mean to put a cheat upon the world, and, by the help of an equivocal expression, to flatter men with the hope of entering, the instant they expire, on a state of felicity; when, in fact, they knew that it would be many ages before it would take place? But, were the hypothesis about the extinction of the mind between death and the resurrection well founded, the apparent coincidence they speak of is not so clear as they seem to think it.

Our author remarks, *thirdly*, that even the various equivocation, (or, perhaps, more properly, mental reservation,) that has been devised for them, will not, in every case, save the credit of apostolical veracity. The words of Paul to the Corinthians are, "Knowing, that whilst we are at home in the body, we are absent from the Lord." Again: "We are willing rather to be absent from the body, and present

present with the Lord." Could such expressions have been used by him, if he had held it impossible to be with the Lord, or indeed any where, without the body; and that, whatever the change was which was made by death, he could not be in the presence of the Lord, till he returned to the body? Absence from the body, and presence with the Lord, were never, therefore, more unfortunately combined, than in this illustration. Things are combined here as coincident, which, in the hypothesis of those gentlemen, are incompatible. If recourse be had to the original, the expressions in Greek are, if possible, still stronger. They are, *οι ενδημιοντες εν τω σωματι*, those who dwell in the body, who are *εκδημιοντες απο τη Κυριας*, at a distance from the Lord; as, on the contrary, they are *οι εκδημιοντες εκ τη σωματος*, those who have travelled out of the body, who are *οι ενδημιοντες προς τον Κυριον*, those who reside, or are present with the Lord. In the passage to the Philippians also, the commencement of his presence with the Lord is represented as coincident, not with his return to the body, but with his leaving it, with the dissolution, not with the restoration, of the union. We may here subjoin an inquiry, how the apostle could be in a *strait betwixt two* (Philip. i. 23.), that of *living in the flesh*, and *being with Christ*, which he pronounces to be *far better*, if the exercise of his powers of service and capacity of enjoyment ceased at death. A mind like his could not hesitate between living in the flesh, and thus serving the Christian cause, and sinking at death into a state of total inaction, and of thus continuing for a long but indefinite period.

The fourth remark made by Dr. Campbell on this subject is, that from the turn of the New Testament, the sacred writers appear to proceed on the supposition, that the soul and the body are naturally distinct and separable, and that the soul is susceptible of pain or pleasure in a state of separation. It were endless to enumerate all the places which evince this. The story of the rich man and Lazarus (Luke, xvi. 22, 23.); the last words of our Lord upon the cross (Luke, xxiii. 46.), and of Stephen when dying; Paul's doubts, whether he was in the body or out of the body, when he was translated to the third heaven and paradise (2 Cor. xii. 2, 3, 4.); our Lord's words to Thomas, to satisfy him that he was not a spirit (Luke, xxiv. 39.); and the express mention of the denial of spirits, as one of the errors of the Sadducees (Acts, xxiii. 8.): these are irrefragable evidences of the general opinion on this subject, both of Jews and Christians. By *spirit*, it is observed, as distinguished from *angel*, is evidently meant the departed spirit of a human being; for that man is here, before his natural death, possessed of a vital and intelligent principle, which is commonly called his soul or spirit, it was never pretended that they denied. It has been said, that this manner of expressing themselves has been adopted by the apostles and evangelists, merely in conformity to vulgar notions. To me, says Dr. Campbell, it appears a conformity, which (if the sacred writers entertained the sentiments of our antagonists in this article) is hardly reconcileable to the known simplicity and integrity of their character.

Before the council of Florence, held in 1439, under pope Eugenius IV., the ancient doctrine, both of the Greek and Latin churches, is said to have been, that the souls of the saints were in *abditis receptaculis*, or in *exterioribus atriis*, where they expected the resurrection of their bodies, and the glorification of their souls; and though the fathers believed all of them to be happy, yet they did not think they would enjoy the beatific vision before the resurrection. But in this council it was decreed, that the souls of those, who, after baptism, have incurred no stain of sin, and also those souls, which having contracted the stain of sin, whether in

their bodies or divested of their bodies, have been purged by the sacrifice of the mass, prayer, and alms, are received into heaven immediately, &c.

In the Lateran council, held under Leo X., in 1513, it was decreed, that the soul is not only truly, and of itself, and essentially the form of the human body, as is expressed in the canon of pope Clement V., published in the general council of Vienne, but likewise immortal, and according to the number of bodies into which it is infused, is singularly multipliable, multiplied, and to be multiplied.

However, Peter Pomponatius, a philosopher of Mantua, published a book in 1516, on the immortality of the soul, in which, after stating the moral arguments against the mortality of the soul, and endeavouring to shew that they are weak and inconclusive, infers upon the whole, that the immortality of the soul, being a problematical question, we can have no assurance of it but from revelation; and that they who would build immortality upon any other foundation, only verify the character given to certain self-sufficient reasoners by the apostle, *viz.* professing themselves wise, they became fools.

In 1520, Luther, in the defence of his propositions, which had been condemned by a bull of Leo X., ranks the natural immortality of the soul among the monstrous opinions of Popery; and he afterwards made use of the doctrine of the sleep of the soul as a confutation of purgatory and saint-worship, and he is said to have continued in that belief to the last moment of his life.

William Tyndall also, the famous translator of the bible into English, in defending Luther's doctrine against sir Thomas More's objections, considers the sleep of the soul as the doctrine of the Protestants in his time, and founded on the scriptures: though, in consequence of the opposition given to this doctrine by Calvin, in his *Psychopannychia*, published in 1534, and the turn hereby given to the sentiments of the Reformed in general, he seems to have recanted his opinion. Calvin, however, seems to have been embarrassed with the souls of the wicked, and says, he would only be responsible for the faithful.

The first express condemnation of the doctrine of the sleep of the soul, in a Protestant confession, occurs in the fortieth of king Edward's Articles, composed in 1552.

After the long prevalence of the doctrine of the intermediate state, that of the sleep of the soul has of late years been revived, and, as one of its zealous advocates affirms, gains ground, not so much from considerations of philosophy, as from a close attention to the sense of the scriptures.

We shall close this article with observing, that a singular hypothesis was advanced a few years ago by Dr. Caleb Fleming, and of late vindicated by an anonymous writer; and this is, that the resurrection takes place immediately after death. On this subject, see Law's Appendix and Postscript to his Considerations on the Theory of Religion, &c. 1774. Historical View of the Controversy concerning an intermediate State, &c. 1772. Priestley's Disquisitions on Matter and Spirit, 1777. Correspondence between Dr. Price and Dr. Priestley, 1778; and the publications of Steffe, Warburton, Goddard, Coward, Peckard, Jortin, &c. on both sides of the question, cited by the author of the Historical View, &c. Fleming's Search after Souls.

SLEEPERS, in *Natural History*, a name given to some animals which sleep all the winter: such as bears, marmots, dormice, bats, hedge-hogs, &c. These do not feed in winter, have no sensible evacuations, breathe little, or not at all, and most of the viscera cease from their functions. Some of these creatures seem to be dead, and others to re-

turn to a state like unto that of the fœtus before birth. In this condition they continue, till by length of time maturating the process, or by new heat, the fluids are attenuated, the solids stimulated, and the functions begin where they left off. See Dr. Stevenfon in *Med. Ed. Edinb.* vol. v. art. 177. See *MIGRATION*.

SLEEPER, in *Building*, a name used for the oblique rafter, that lies in a gutter.

SLEEPERS, in the *Glass Trade*, are the large iron bars crossing the smaller ones, and hindering the passage of the coals, but leaving room for the ashes.

SLEEPERS, in the *Military Art*. See *PLATFORM*.

SLEEPERS, in *Ship-Building*, pieces of long compass-timber, fayed and bolted diagonally upon the transoms and timbers adjoining withinside, to strengthen the buttock of the ship. There are from two to three pairs.

SLEEPY CREEK, in *Geography*, a river of America, in North Carolina, which runs into the Atlantic, N. lat. 34° 43'. W. long. 76° 44'.

SLEETS, in *Gunnery*, are the parts of a mortar, passing from the chamber to the trunnions, for strengthening that part.

SLEEVE, *HIPPOCRATES'S*. See *HIPPOCRATES*.

SLEIDAN, *JOHN*, in *Biography*, a celebrated historian, was born in 1506 at Sleidan, a small town at Cologne. His origin, it has been inferred, was obscure, because he took no other name than that of the town in which he was born. He received the early part of his education in his native country, and then went to Paris, whence he removed to Orleans, in order that he might study the law as a profession. On his return to Paris, he was recommended by his countryman and school-fellow, J. Sturmius, to cardinal archbishop du Bellay, who obtained for him a pension, and initiated him into the routine of public business. In 1542 he was obliged, owing to his attachment to the reformed religion, to retire to Strasburg. He was at first a follower of Zuingle, but he afterwards joined the Lutherans, and became a considerable writer in their defence. He was also entrusted with employments of considerable importance to the welfare of the party which he had joined. In 1545 he was deputed to the king of England; and in 1551 he was one of the Protestant envoys to the council of Trent, which, however, was soon dissolved by the troops of Maurice, elector of Saxony. The death of his wife, which happened in 1555, threw him into a deep melancholy, which had the calamitous effect of obliterating his memory to such a degree, that he did not know even his own children. He died at Strasburg, in the following year. He is chiefly known as an author by a work, entitled "De Statu Religionis et Reipublicæ Carolo Quinto Cæsare, Commentaria, Lib. XXV." which was first published in 1555. It comprehends the history of his own times, from 1517 to the year of its publication, and has always been in great credit among the Protestants; though it has been charged with partiality by Catholic writers, and by the adherents of the emperor Charles. "Much of it," says his biographer, "is extracted from public records, and from the archives of the city of Strasburg, with which he was furnished by his friend J. Sturmius." De Thou speaks of it as a work drawn up "exacta fide et diligentia," and he praises very highly the writer's learning and talents for business. This work has been translated into several modern languages: the French version was made by Le Courayer. Another celebrated work of Sleidan's is a compendium of ancient history, entitled "De quatuor Summis Imperiis, Lib. tres," which has gone through a great number of editions. He published likewise a Latin translation of the History of

Philip de Comines, and an abridgment of that of Froissart, besides versions of other works on general history and politics.

SLEKTENES, in *Geography*, a small island in the North sea, near the coast of Lapland. N. lat. 70° 25'.

SLEMISH, or *SLENISH*, a mountain of the county of Antrim, Ireland, near the centre, and forming a very conspicuous object from most parts of the county. Dr. Richardfon calls it a round *hummock*, formed by an accumulation of rectilinear basaltic strata of steady parallelism. The height, as measured by the barometer, is 1398 feet. See *HUMMOCK*.

SLESWICK, *Duchy of*, sometimes called South Jutland, (see *DENMARK* and *JUTLAND*,) a province of Denmark, bounded on the north by Jutland, on the east by the Baltic, on the south by the duchy of Holstein, and on the west by the North sea; about 72 miles in length, and from 30 to 56 in breadth, without including several islands on the coast. The country is well supplied with corn, cattle, and fish; it has no mountains, and but few eminences that deserve the name of hills. The soil is, in general, well cultivated, and agriculture is much encouraged by the crown. Sleswick has from time immemorial been united to Denmark, but has sometimes been given to a brother of the reigning king, as a fief; but this grant has produced considerable disputes, more especially in the last century, when the duke in possession attempted to become an independent prince. In 1720 it was recovered to the crown. The administration is vested in a governor, chancellor, vice-chancellor, and counsellors: the governor resides at Gottorp. The inhabitants are a mixture of Danes, Saxons, Frisicians, and Hollanders, who respectively speak their own languages. The prevalent religion is Lutheran. This duchy contains several towns, and 1500 villages.

SLESWICK, the capital of the above duchy, situated on the river or gulf of Sley; formerly called "Hetheby," from queen Hetha, who was the founder. After having undergone a variety of vicissitudes, it is now no longer a port, the Sley being choked up with sand. It is an irregular town of great length, and contains about 5630 inhabitants. The houses are constructed with brick, and in neatness and manner of building resemble those of Holland; the inhabitants are also the Dutch, and many of them speak their tongue, though the usual languages are the German and the Danish. Close to Sleswick is the old palace of Gottorp, which is a large brick edifice, surrounded with a rampart and moat. It was formerly the ducal residence, and more lately inhabited by the stadtholder or governor, prince Charles of Hesse Cassel, who married Louisa, princess of Denmark. From this castle the ducal line, formed by Adolphus, son of Frederic I. king of Denmark, was denominated Holstein-Gottorp, which still subsists in the person of the great duke of Russia; 60 miles N. of Hamburg. N. lat. 54° 33'. E. long. 9° 34'.

SLETDALER, or *Basse Rixdollar*, in *Commerce*, a money of account in Denmark, reckoned at 4 marks, or 64 skillings Danish.

SLICES, in *Ship-Building*, tapering pieces of plank, used to drive between the timbers before planking, as now practised in the navy, for setting up a ship on her ways for launching, &c.

SLICH, in *Metallurgy*, the ore of any metal, particularly of gold, when it has been pounded, and prepared for farther working.

The manner of preparing the slich at Cremnitz, in Hungary, is this: they lay a foundation of wood three yards deep, upon this they place the ore, and over this there are four-

four-and-twenty beams, armed at their bottoms with iron; these, by a continual motion, beat and grind the ore, till they reduce it to powder: during all this operation, the ore is covered with water. There are four wheels used to move these beams, each wheel moving six; and the water, as it runs off, carrying some of the metalline particles with it, is received into several basons, one placed behind another; and finally, after having passed through them all, and deposited some sediment in each, it is let off into a very large pit, of almost half an acre of ground; in this it is suffered to stand so long, as to deposit all its sediment, of whatever kind, and after this it is let out. This work is carried on day and night, and the ore taken away, and replaced by more, as often as occasion requires. That ore which lies next the beams, where it was pounded, is always the cleanest or richest.

When the slich is washed as much as they can, a hundred weight of it usually contains about an ounce, or perhaps but half an ounce of metal; which is not all gold, for there is always a mixture of gold and silver, but the gold is in the largest quantity, and usually is two-thirds of the mixture: they then put the slich into a furnace with some lime-stone, and slaken, or the scoria of former meltings, and run them together. The first melting produces a substance, called *leeb*; this leeb they burn with charcoal, to make it lighter, to open its body, and render it porous, after which it is called *ross*; to this rost they add sand in such quantity as they find necessary, and then melt it over again.

They have at Cremnitz many other ways of reducing gold out of its ore, but particularly one, in which they employ no lead during the whole operation; whereas, in general, lead is always necessary, after the before-mentioned processes. See GOLD.

SLICKENBORCH, in *Geography*, a town of Holland, in the state of Friesland, on the river Linde, at its union with the Kuynder; 28 miles S. of Lewarden.

SLICKENBURG, a small island near the N.W. coast of Borneo. N. lat. $3^{\circ} 59'$. E. long. $112^{\circ} 31'$.

SLIDE-Butt, in *Agriculture*, a sort of sledge contrived in the form of a strong, oblong box, and slid underneath with strong, rough, thick pieces of timber. It is capable of holding about three or four common wheel-barrows full of earth or compost. In Cornwall and other hilly districts, it is found useful and convenient for drawing out dung and other dressings to small distances from the large heaps deposited in the fields or other places. They are used with one or two oxen or horses for the most part. They have sometimes also low wheels, when they are denominated gurry butts in the above county.

SLIDE-Rails, or *Guard-Rails*, in the construction of *Canals*, are long pieces of timber fixed to piles or plugs in the face of the walls of locks, bridges, tunnels, &c. generally a little above the surface of the water, to prevent boats from striking and injuring the walls.

SLIDING, in *Mechanics*, *Superincessus radens*, is, when the same point of a body, moving along a surface, describes a line on that surface.

Such is the motion of a parallelepiped, protruding along a plane.

SLIDING-Rule, a mathematical instrument, serving to work questions in gauging, measuring, &c. without the use of compasses; merely by the sliding of the parts of the instrument one by another, the lines and divisions of which give the answer, by inspection.

This instrument is variously contrived, and applied by various authors, particularly Everard, Coggeshall, Gunter,

Hunt, and Partridge; but the most usual and useful ones are those of Everard and Coggeshall; the description and uses of which are as follow.

SLIDING-Rule, *Everard's*, is principally used in gauging; being ordinarily made of box, a foot long, an inch broad, and $\frac{1}{16}$ ths of an inch thick. It consists of three parts: a rule, on each side of which, *ab* and *cd* (*Plate VII. Surveying, fig. 4.*) is a groove, and two small scales, or sliding-pieces, *m, n*, slide in the grooves. When both these pieces are drawn out to their full extent, the instrument is three feet long.

On the first broad face of the instrument, *ab*, are four lines of numbers; for the properties, &c. of which, see GUNTER'S *Line*. The first, marked A, consisting of two radiuses numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 1; and then 2, 3, 4, 5, &c. to 10. On this line are four brass centre-pins, two in each radius; one in each of which is marked MB, to signify that the number it is set against, 2150.42, is the number of cubic inches in a malt-bushel; the other two are marked with A, to signify that the numbers they are set against, *viz.* 282, are the cubic inches in an ale-gallon. The second and third lines of numbers are on the sliding-pieces, and are exactly the same with the first. They are distinguished by the letter B. Close to the figure 7, in the first radius, is a dot, marked Si, set exactly over .707, denoting .707 to be the side of a square inscribed in a circle, whose diameter is unity. Close to 9 is another dot, marked Se, set over .886, which is the side of a square equal to the area of a circle, whose diameter is unity. Another dot, near W, is set over 231, the number of cubic inches in a wine-gallon; and another, near C, is set over 3.14, the circumference of a circle, whose diameter is unity. The fourth line of numbers, marked MD, to signify *malt depth*, is a broken line of two radiuses, numbered 2, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 9, 8, 7, &c. the number 1 being set directly against MB on the first radius.

On the second broad face, marked *cd*, are 1. A line of numbers of one radius, numbered 1, 2, 3, &c. to 10, noted by the letter D. On this are four centre-pins; the first, marked WG, is the gauge-point for a wine-gallon, *i. e.* the diameter of a cylinder, whose height is an inch, and content 231 cubic inches, or a wine-gallon, which is 17.15 inches: the second centre-pin, AG, stands at the gauge-point for an ale-gallon, which is 18.95 inches. The third, MS, stands at 46.3, the side of a square, whose content is equal to the inches in a solid bushel. The fourth, MR, is the gauge-point for a malt-bushel, which is 52.32 inches. 2. Two lines of numbers on the sliding-piece, which are exactly the same as those on the sliding-piece on the other side, called C. Close to the division 8 is a dot, marked e, which is set to .795, the area of a circle, whose circumference is unity; and another, marked d, stands at .785, the area of a circle, whose diameter is unity. 3. Two lines of segments, each numbered 1, 2, 3, to 100; the first, for finding the ullage of a cask, taken as the middle frustum of a spheroid, lying with its axis parallel to the horizon; and the other for finding the ullage of a cask standing.

Again, on one of the narrow sides, noted e, are 1. A line of inches, numbered 1, 2, 3, &c. to 12, each subdivided into ten equal parts. 2. A line, by which, with that of inches, we find a mean diameter for a cask, in the figure of the middle frustum of a spheroid: it is numbered 1, 2, 3, &c. to 7, and marked *spheroid*. 3. A line for finding the mean diameter of a cask, in the figure of the middle frustum of a parabolic spindle, which gaugers call the *secondary variety of casks*; it is numbered 1, 2, 3, &c. and noted *second variety*. 4. A line, by which we find the mean

SLIDING-RULE.

mean diameter of a cask of the third variety, *i. e.* of a cask in the figure of two parabolic conoids, abutting on a common base; it is numbered 1, 2, 3, &c. and noted *third variety*.

On the other narrow face, marked *f*, are, 1. A foot divided into 100 equal parts, marked F M. 2. A line of inches, like that before-mentioned, noted I M. 3. A line for finding the mean diameter of a fourth variety of casks, which is the middle frustum of two cones, abutting on a common base. It is numbered 1, 2, 3, &c. and noted F C, signifying frustum of a cone.

On the back side of the two sliding-pieces is a line of inches, from 13 to 36, when the two pieces are put endwise; and against that, the correspondent gallons, or hundred parts, that any small tub, or the like open vessel (from 13 to 36 inches diameter), will contain at one inch deep.

Mr. Overley, and other writers on this subject, have suggested some improvements in the construction of this instrument. See Overley's Young Gauger's Instructor, p. 108.

SLIDING-Rule, Use of Everard's.—1. To multiply one number by another. Suppose 4 required to be multiplied by 6: set 1 on the line of numbers B, to 4 on the line A; then, against 6 upon B is 24, the product sought upon A. Again, to multiply 26 by 68, set 1 on B to 26 on A; then, against 68 on B is 1768 on A, the product sought.

2. To divide one number by another. Suppose 24 to be divided by 4: set 4 on B to 1 on A; then against 24 on B is 6 on A, which is the quotient. Again, to divide 952 by 14; set 14 on A to 1 on B, and against 952 on A, you have, on B, 68, which is the quotient.

3. To work the rule of three. If 8 gives 20, what will 22 give? Set 8 on B to 20 on A, then against 22 on B stands 55 on A, the number sought.

4. To find a mean proportional between two numbers, suppose between 50 and 72: set 50 on C to 72 on D; then against 72 on C you have 60 on D, which is the mean required.

5. To extract the square root of a number. Apply the lines C and D to one another, so that 10 at the end of D be even with 10 at the end of C; then are these two lines a table, shewing the square root of any number less than 1000000 by inspection: for against any number on C, the number answering to it on D is the square root of it.

Note, if the given number consists of 1, 3, 5, or 7 places of integers, seek it on the first radius, on the line C, and against it is the root required at D.

6. Either the diameter or circumference of a circle, being given, to find the other. Set 1 on the line A against 3.141 (to which is written C) on the line B; and against any diameter on the line A, you have the circumference on B, and contrariwise: thus, the diameter being 20 inches, the circumference will be 62.831 inches; and the circumference being 94.247, the diameter will be 30.

7. The diameter of a circle given, to find the area in inches, or in ale or wine-gallons. Suppose the diameter 20 inches, what is the area? Set 1 upon D, to .785 (noted *d*) on C; then against 20 on D is 314.159, the area required. Now, to find that circle's area in ale-gallons, set 18.95 (marked A G) upon D, to 1 on C; then against the diameter 20 upon D, is the number of ale-gallons on C, *viz.* 1.11. The same may serve for wine-gallons, regard being only had to the proper gauge-point.

8. The two diameters of an ellipsis being given, to find the area in ale-gallons. Suppose the transverse diameter 72 inches, and the conjugate 50: set 359.05, the square of the gauge-point, on B, to one of the diameters (suppose 50)

on A; then against the other diameter 72 on B, you will have the area on A, *viz.* 10.02 gallons, the content of this ellipsis at one inch deep. The like may be done for wine-gallons, if, instead of 359.05, you use 249.11, the square of the gauge-point for wine-gallons.

9. To find the area of a triangular surface in ale-gallons. Suppose the base of the triangle 260 inches, and the perpendicular let fall from the opposite angle 110 inches: set 282 (marked A) upon B, to 130, half the base, on A; then against 110 on B is 50.7 gallons on A.

10. To find the content of an oblong in ale-gallons. Suppose one side 130 inches, and the other 180: set 282 on B, to 180 on A; then against 130 upon B is 82.97 ale-gallons, the area required.

11. To find the content of a regular polygon in ale-gallons, one of the sides being given. Find the length of the perpendicular let fall from the centre to one of the sides: this, multiplied by half the sum of the sides, gives the area. For an instance; suppose a pentagon, whose side is 1 inch, here the perpendicular will be found .837, by saying, as the sine of half the angle at the centre, which, in this polygon, is 36°, is to half the given side .5, so is the sine of the complement of 36°, *viz.* 54°, to the perpendicular aforesaid. Whence the area of a pentagon, whose side is unity, will be found 1.72 inches, which, divided by 282, gives .0061, the ale-gallons in that polygon.

12. To find the content of a cylinder in ale-gallons. Suppose the diameter of the base of the cylinder 120 inches, the perpendicular height 36 inches: set therefore the gauge-point (A G) to the height 36 on C; then against 120, the diameter on D, is found 1443.6, the content in ale-gallons.

13. The bung and head-diameters of any cask, together with its length, being given; to find its content in ale or wine-gallons. 1. Suppose the length of a cask taken (as the middle frustum of a spheroid, which is the first case or variety) be 40 inches, its head-diameter 24 inches, and bung-diameter 32 inches: subtract the head-diameter from that of the bung, the difference is 8. Look, then, for 8 inches on the line of inches, on the first narrow face of the rule; and against it, on the line *spheroid*, stands 5.6 inches, which, added to the head-diameter 24, gives 29.6 inches for that cask's mean diameter: set, therefore the gauge-point for ale (marked A G) on D, to 40 on C; and against 29.6 on D, is 97.45, the content of the cask in ale-gallons. If the gauge-point for wine (marked W G) be used instead of that for ale, you will have the vessel's content in wine-gallons.

2. If a cask, of the same dimensions as the former, be taken (as the middle frustum of a parabolic spindle, which is the *second variety*), see what inches, and parts, on the line marked *second variety*, stand against the difference of the bung and head-diameters, which, in this example, is 8; and you will find 5.1 inches, which, added to 24, the head-diameter, makes 29.1 inches, the mean diameter of the cask: set, therefore, the rule, as before, and against 29.1 inches, you will have 94.12 ale-gallons for the content of the cask.

3. If the cask taken be the middle frustum of two parabolic conoids, which is the third variety; against 8 inches, the difference of the head and bung-diameters, on the line of inches, you will find 4.57 inches on the line called *third variety*; this, added as before to 24, gives 28.57 for the cask's mean diameter; proceeding, as before, you will find the content 90.8 gallons.

4. If the cask taken be the frustums of two cones, which is the *fourth variety*, against 8 inches on the line of inches,

you will find on the line marked F C, 4.1 inches to be added to 24 inches: the rest, carried on as before, gives the content of the cask 87.93 ale-gallons.

14. A cask partly empty, lying with its axis parallel to the horizon; to find the quantity of liquor in it. Find its whole content as above, which suppose 97.455 gallons; and suppose the inches left dry, 8, and the bung-diameter 32: then, as the bung-diameter on C is to 100 on the line of segments L, so are the dry inches on C to a fourth number on the line of segments: and as 100 upon B is to the cask's whole content on A, so is that fourth number to the liquor wanting to fill up the cask, which, subtracted from the whole content of the cask, gives the liquor remaining therein; *e. gr.* set 32, the bung-diameter on C, to 100 on the segment-line L; then against 8, the dry inches on C, stands 17.6 on the segment-line: set, therefore, 100 on B to the cask's whole content on A; and against 17.6 on B, you have 16.5 gallons on A: subtracting, therefore, the said gallons from 97.45, the vessel's whole content, the liquor in the cask will be 80.95 gallons.

15. A cask standing upright, or with its axis perpendicular to the horizon, to find the liquor therein. Suppose the length of the cask 40 inches, and 10 of them dry; set 40 inches on the line C, to 100 on the segment-line S; and against 10, the dry inches on the line C, stands 24.2 on S, the segment-line. Set then 100 on B to 97.455, the cask's whole content on A; and against 24.2 on B, you will have 23.5 gallons, which is what is wanting to fill up the cask: this, therefore, subtracted from the whole content 97.455, gives 73.955 gallons, for the quantity of liquor remaining in the cask.

16. To find the content of any right-angled parallelepiped (*e. gr.* a cistern, uting-fat, or the like) in malt bushels. Suppose the length of the base 80 inches, the breadth 50, and depth 9 inches; set the breadth 50 on B, to the depth 9 on C; then against the length 80 on A, stand 16.8 bushels on B, the number required.

SLIDING-Rule, *Coggeshall's*, is principally used in measuring of the superficies and solidity of timber, &c.

It consists of two rulers, each a foot long, which are framed or put together various ways; sometimes they are made to slide by one another, like glaziers' rules: sometimes a groove is made in the side of a common two-foot joint-rule, and a thin sliding-piece put in, and *Coggeshall's* lines added on that side: but the most usual and commodious way is, to have one of the rulers slide in a groove made along the middle of the other, as it is represented in *Plate VII. Surveying, fig. 5.*

On the sliding side of the rule are four lines of numbers, three of which are double, that is, are lines to two radiuses, and one, a single broken line of numbers: the three first, marked A, B, C, are figured 1, 2, 3, &c. to 9; then 1, 2, 3, &c. to 10. Their construction, use, &c. are the same as those on Everard's sliding rule. The single line, called the *girt-line*, and noted D, whose radius is equal to the two radiuses of any of the other lines, is broken, for the easier measuring of timber, and figured 4, 5, 6, 7, 8, 9, 10, 20, 30, &c. from 4 to 5. It is divided into 10 parts, and each tenth subdivided into two, and so on from 5 to 10, &c.

On the backside of the rule are, 1. A line of inch-measure, from 1 to 12; each inch being divided and subdivided.

2. A line of foot-measure; consisting of one foot, divided into 100 equal parts, and figured 10, 20, 30, &c. The backside of the sliding-piece is divided into inches,

halves, &c. and figured from 12 to 24; so that when slid out, there may be a measure of two feet.

SLIDING-Rule, in measuring plain superficies, use of *Coggeshall's*. 1. To measure a square. Suppose, *e. gr.* the sides be each five feet: set 1 on the line B, to 5 on the line A; then against 5 on the line B is 25 feet, the content of the square on the line A.

2. To measure a long square. Suppose the longest side 18 feet, and the shortest 10: set 1 on the line B, to 10 on the line A: then against 18 feet on the line B is 180 feet, the content on the line A.

3. To measure a rhombus. Suppose the side 12 feet, and the length of a perpendicular let fall from one of the obtuse angles to the opposite side, 9 feet: set 1 on the line B, to 12, the length of the side, on the line A; then against 9, the length of the perpendicular on the line B, is 108 feet, the content.

4. To measure a triangle. Suppose the base 7 feet, and the length of the perpendicular let fall from the opposite angle to the base 4 feet: set 1 on the line B, to 7 on the line A: then against half the perpendicular, which is 2 on the line B, is 14 on the line A, for the content of the triangle.

5. To find the content of a circle, its diameter being given. Suppose the diameter 3.5 feet: set 11 on the girt-line D, to 95 on the line C; then against 3.5 feet on D, is 9.6 on C, which is the content of the circle in feet.

6. To find the content of an oval or ellipsis. Suppose the longest diameter 9 feet, and the shortest 4. Find a mean proportional between the two, by setting the greater 9 on the girt-line, to 9 on the line C; then, against the less number 4, on the line C, is 6, the mean proportional sought. This done, find the content of a circle, whose diameter is 6 feet; this, when found by the last article, will be equal to the content of the ellipsis sought.

SLIDING-Rule, in measuring timber, use of *Coggeshall's*.

1. To measure timber the usual way. Take the length in feet, half feet, and, if required, quarters; then measure half-way back again; there girt the tree with a small cord or line; double this line twice, very evenly; and measure this fourth part of the girt or perimeter, in inches, halves, and quarters. The dimensions thus taken, the timber is to be measured as if square, and the fourth of the girt taken for the side of the square, thus; set 12 on the girt-line D, to the length in feet on the line C; then against the side of the square, on the girt-line D, taken in inches, you have, on the line C, the content of the tree in feet.

For an instance: suppose the girt of a tree, in the middle, be 60 inches, and the length 30 feet, to find the content: set 12 on the girt-line D, to 30 feet on the line C; then against 15, one-fourth of 60, on the girt-line D, is 46.8 feet, the content on the line C. If the length should be 9 inches, and the quarter of the girt 35 inches, here, as the length is less than a foot, measure it on the line of foot-measure, and see what decimal part of a foot it makes, which you will find .75: set 12, therefore, on the girt-line, to 75 on the first radius of the line C, and against 35 on the girt-line is 6.4 feet on C, for the content.

2. To measure round timber the true way. The former method, though that generally in use, is not quite just. To measure timber accurately, instead of the point 12 on the girt-line, use another, *viz.* 10.635; at which there should be placed a centre-pin. This 10.635 is the side of a square equal to a circle, whose diameter is 12 inches. For an instance: suppose the length 15 feet, and $\frac{1}{4}$ th of the girt 42 inches: set the point 10.635 to 15, the length; then

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then against 42 on the girt-line is 233 feet for the content sought; whereas, by the common way, there arise only 184 feet. In effect, the common measure is only to the true measure, as 11 to 14. See **TIMBER**.

3. To measure a cube. Suppose the sides to be 6 feet each: set 12 on the girt-line D, to 6 on C; then against 72 inches (the inches in 6 feet) on the girt-line are 216 feet on C, which give the content required.

4. To measure unequally squared timber; that is, where the breadth and depth are not equal. Measure the length of the piece, and the breadth and depth (at the end) in inches; then find a mean proportional between the breadth and depth of the piece. This mean proportional is the side of a square equal to the end of the piece: which found, the piece may be measured as square timber.

For an instance: let the length of the piece of timber be 13 feet, the breadth 23 inches, and the depth 13 inches: set 23 on the girt-line D, to 23 on C; then against 13 on C is 17.35 on the girt-line D for the mean proportional. Again, setting 12 on the girt-line D to 13 feet, the length on the line C, against 17.35, on the girt-line is 27 feet, the content.

5. To measure taper timber. The length being measured in feet, note one-third of it; which is found thus: set 3 on the line A, to the length on the line B; then against 1 on A is the third part on B: then if the solid be round, measure the diameter at each end in inches, and subtract the less diameter from the greater; add half the difference to the less diameter; the sum is the diameter in the middle of the piece. Then set 13.54 on the girt-line D to the length on the line C, and against the diameter in the middle, on the girt-line, is a fourth number on the line C. Again, set 13.54 on the girt-line to the third part of the length on the line C; then against half the difference on the girt-line, is another fourth number on the line C: these two fourth numbers, added together, give the content. For an instance: let the length be 27 feet (one-third of which is 9), the greater diameter 22 inches, and the less 18; the sum of the two will be 40, their difference 4, and half the difference 2, which, added to the less diameter, gives 20 inches for the diameter in the middle of the piece. Now, set 13.54 on the girt-line, to 27 on the line C, and against 20 on D is 58.9 feet. Again, set 13.54 on the girt-line to 9 on the line C; and against 2 on the girt-line (represented by 20) is .196 parts; therefore, by adding 58.9 feet to .196 feet, the sum is 59.096 feet, the content.

If the timber be square, and has the same dimensions; that is, the length 27 feet, the side of the greater end 22 inches, and that of the lesser 18 inches; to find the content: set 12 on the girt-line to 27, the length on the line C; and against 20 inches, the side of the mean square on the girt-line, is 75.4 feet. Again, set 12 on the girt-line to 9 feet, one-third of the length, on the line C; and against 2 inches, half the difference of the sides of the squares of the ends on the girt-line, is .25 parts of a foot: both together make 75.65 feet, the content of the solid.

The girt or circumference of a tree, or round piece of timber, given; to find the side of the square within, or the number of inches of a side when the round timber is squared. Set 10 on A to 9 on B; then against the girt on A are the inches for the side of the square on the line B. See **DENDROMETER**.

Dr. ROGET has lately communicated to the Royal Society the "Description of a new Instrument for performing the Involution and Evolution of Numbers," by which he has very

much improved the construction, and extended the application of the "sliding-rule."

In his ingenious paper on this subject, he has stated and elucidated the general principles on which instruments of this kind are constructed, and the ordinary purposes to which they are applicable. It is well known, that the Gunter's line and common sliding-rule are derived from the properties of logarithms, and that their primary use consists in facilitating the *multiplication* and *division* of numbers. (See **GUNTER'S Line** and **GUNTER'S Scale**.) Our author's instrument is founded on a particular mode of employing logarithms, and is designed for immediate application to the *involution* and *evolution* of numbers. The common sliding-rule, it is obvious, serves for comparing the intervals between the numbers on Gunter's scale; and for this purpose it consists of a scale, called the slider, exactly of the same length with the former, and bearing the same divisions, which, by being moveable along the side of the other, allows of the application of any part of the one to any part of the other. If the two scales originally coincide, and the sliding scale is the undermost, then, by advancing the slider through any given distance, each of its divisions will be brought under those of the fixed scale, which before were respectively situated farther forwards by an interval equal to that given distance. Every number in the upper scale will therefore have to the number standing under it on the slider the same constant ratio; a ratio indicated by the number under which the unity, or commencement of the scale of the slider has been placed. The former numbers will therefore be the multiples of the latter by this constant number. Thus, by adjusting the slider so that its unity shall stand under any given multiplier or divisor, the upper line will exhibit the series of the products of all the subjacent numbers by the given multiplier; and conversely, the slider will exhibit the series of the quotients resulting from the division of the numbers immediately above them by the given divisor. In order to facilitate the general use of the sliding-rule, Dr. ROGET has pointed out the following proposition, as leading directly to the solution of every case to which the instrument can be applied. "In every position of the slider, all the fractions formed by taking the numbers on the upper line as numerators, and those immediately under them as denominators, are equal. Thus, every corresponding numerator and denominator, having to each other the same ratio, may be considered as two terms of a proportion. Any two of these equivalent fractions will therefore furnish the four terms of a proportion; of which any unknown term may be supplied when the others are given, by moving the slider till the numbers composing the terms of the given fraction are brought to coincide on the two lines. The required term will then be found occupying its proper place opposite to the other given term. Thus, from the proportion $A : B :: C : D$, we may derive

$$\frac{A}{B} = \frac{C}{D}; \text{ and adjusting the slider so that } B \text{ shall stand under}$$

A , D will be found under C , when C is given; or C will be found over D , when D is given. A similar process would have furnished A or B , when one of them, together with C and D , were given. Since the products of each numerator by the denominator of the other fraction are equal (that is, $AD = BC$); when one of the terms is unity, the question becomes one of simple multiplication or division. The product of A and B , which we may call P , will be found as before, by placing the slider so as to express the frac-

$$\text{tions } \frac{A}{1} = \frac{P}{B}. \text{ The quotient of } A \text{ divided by } B, \text{ which}$$

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we may call Q , will in like manner be found by forming the fractions $\frac{A}{B} = \frac{Q}{1}$; that is, in the former case, the product P will stand over B , when the 1 on the slider is brought under A ; and in the latter case, the quotient Q will stand over the 1 of the slider when B is brought under A ."

The sliding-rule has been variously modified, so as to serve for the calculation of exchanges, the measurement of plane and solid bodies, and the computations of trigonometry; and lately by Dr. Wollaston, in his synoptic scale of chemical equivalents; but notwithstanding these modifications, its use is necessarily limited to operations that are performed by the simple addition or subtraction of logarithms, and to the corresponding arithmetical operations above mentioned. It is not directly adapted to perform the involution or evolution of numbers, to which the multiplication and division of logarithms correspond. (See LOGARITHM.) Nevertheless, questions that involve geometrical progressions, or exponential quantities, and the computation of the terms of a series in obtaining approximate solutions, not infrequently occur. The common sliding-rule affords no direct method of determining even the simple power or root of any given number; but when the exponent of the required power or root is not an integral, but a fractional number, it is still more inadequate to the solution of the question. Indeed, the squares and square roots are often pointed out on the common rules by means of a supplementary line graduated so that each of its divisions is double in length to those of the other two lines. A line of cubes, or cube-roots, or of any other given power, might, in like manner, be subjoined. But the uses of such additional lines are restricted to cases where a particular power is concerned; but they afford no assistance in the case of any other power or root, which is not immediately related to the power.

Dr. Roget adopts a new mode of graduation, exhibiting on simple inspection all the powers and roots of any given number to any given exponent, with the same facility, and in the same way, that products, quotients, and proportionals are exhibited by the common sliding-rule. Accordingly it is a measure of powers, just as the scale of Gunter is a measure of ratios. The principle of its construction will be best illustrated by an example. If it were required to raise the number 2.123 to the fifth power; with the use of logarithms we should multiply the log. of 2.123 (or 0.32695) by 5 ; the product (1.63475) would be found by the tables to correspond to 43.127 , the fifth power of 2.123 . If the exponent, instead of being a whole number 5 , were fractional, as 4.3719 , the operation may be abridged by the aid of logarithms: thus, add the log. of 0.32695 or 9.5144813 , to that of 4.3719 or 0.6406702 , and the sum, or 0.1551525 , is a logarithm answering to the number 1.4294 , the product required, *viz.* 26.878 , or $\overline{2.123}^{4.3719}$.

In this example, the first of the numbers added together is the logometric logarithm (that is, the logarithm of the logarithm) of the given root; the second is the simple logarithm of the exponent, and the sum of these is the logometric logarithm of the power. If a table were constructed having three sets of columns, the first containing the natural series of numbers, the second their corresponding logarithms, and the third the logarithms of those logarithms, we should be able to raise any given number to any given power, by the simple addition of the numbers in the second and third columns; as common multiplications are performed by the addition of common logarithms. Hence it

is evident, that a line might be graduated so that its divisions should correspond to the numbers in the third column, or represent the logometric logarithms of the numbers marked upon them; and if this line were applied so as to slide against another line logometrically divided, we might be able by it to perform the operation that has been described; and we should thus have, by inspection, the powers corresponding to any given root and exponent.

The instrument proposed would therefore, in its simplest form, consist of two graduated scales applied to each other.

In *Plate VII. Surveying, fig. 6.* a portion of these scales is represented. The lower rule AA , called the slider, is the common Gunter's double line of numbers, or a line logometrically divided; the divisions of the first half being from 1 to 10 , and repeated on the second half in the same order. The upper, or fixed rule BB , is so graduated, that each of its other divisions is set against its respective logarithm on the slider; and, consequently, all the numbers on the slider will be situated immediately under those numbers in the upper rule, of which they are the logarithms. Thus, 2 on the rule will be over 0.30103 of the slider; 3 over 0.47712 ; 2 on the slider will stand under 100 on the rule; 3 under 1000 , and so on.

As the series of ordinary logarithms express the exponents of 10 , of which the corresponding numbers are so many successive powers, in this position of the instrument it is evident, that the upper line will exhibit the series of the powers of 10 , corresponding to all the exponents marked on the slider. *E. gr.* The $2d$ power of 10 is 100 ; the $3d$, 1000 , &c.; the $0.5th$ (or the square root) is 3.163 ; the $0.25th$ (or $4th$ root) is 1.778 ; the $0.2th$ (or the $5th$ root) is 1.585 , &c.

In every other position of the slider, the upper rule will exhibit, in like manner, the series of powers of that number, under which the unit of the slider has been placed, while the opposite numbers on the slider are the exponents of those powers. Thus, if (*Plate VII. fig. 7.*) the unit of the slider be placed under the division 3 of the upper rule (at R), the square of 3 , or 9 , will be found over the 2 of the slider; its cube, 27 , over the 3 ; its $4th$ power, 81 , over the 4 , &c. Hence, in order to find a given power of any number, the unit of the slider must be set underneath that number in the upper rule; and the number sought will then be found above that number in the slider, which expresses the magnitude of the required power. The use of the instrument will be obvious in performing the contrary operation of finding the roots. In this case the root might be considered as a fractional power; but as this would require a reduction into decimals, the easiest mode will be to place the number expressing the degree of the required root under the given number, and the root itself will then be found over the unit, or beginning of the scale, in the slider. For fractional powers, the denominator of the exponent must be placed under the root, and its numerator will then point out the power. By the same mode we may discover the exponent of any given power to any given root; since, whatever be the root over the unit of the slider, the whole series of the powers of that root, with their corresponding exponents, are rendered apparent. This circumstance may be considered as an additional recommendation to the employment of this instrument; for it affords to those less versed in the contemplation of numerical relations, an ocular illustration of the theory of involution. It presents, at one view, the whole series of powers arising from the successive multiplication of all possible numbers, whether entire or fractional; and exhibits this series in its whole continuity, when the exponents are fractional, and even incommensurate

with

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with the root itself. The production of the upper line in one direction, conveys a more accurate notion of the progressive and rapid increase of those powers, than can be acquired by mere abstract reflection; and its continuation on the other side shews the slow approximation to unity which takes place in the successive extractions of higher and higher roots. Among the variety of forms of construction of which instruments that operate on the principle now explained are capable, Dr. Roget conceives the following to be, upon the whole, the most convenient for practical purposes. Its representation, on a reduced scale, appears in *Plate VII. fig. 8.* With a view of preserving a sufficient extent of scale, the line of roots and powers is divided into two parts; one being placed above and the other below, and between them a slider with a double scale of exponents. The slider of the common sliding-rule is graduated in a way that is exceedingly well suited to this purpose, having divisions on each edge, and carrying two sets of numbers from 1 to 10. Adapting a blank ruler to one of these sliders, which must be fixed in a proper position, Dr. Roget marks off, on the upper line, the series of numbers against their respective logarithms on the sliders; placing 10 over the middle unit of the slider, 100 over the 2, 1000 over the 3, and so on, proceeding towards the right, from 10 to 1000000000, the 10th power of 10; an extent which is more than sufficient for all useful purposes. The space to the left is also graduated on the same principle, from 10 to 1.259, which is the 10th root of 10, or $10^{0.1}$. The upper portion of the rule being thus filled, Dr. R. places the continuation of the same line on the lower portion, beginning on the right hand, and proceeding in a descending series of fractional powers of 10, corresponding with the exponents on the intermediate slider, which, when applied to this portion, are to be taken as only $\frac{1}{10}$ th of their value when applied to the upper portion. While 1.259 therefore is marked on the right, $1.0233 (= 10^{0.01})$ will occupy the middle, and $1.002305 (= 10^{0.001})$ the left end of the lower line. The graduation, it is plain, might be thus continued indefinitely in both directions. But for all practical purposes, the limits thus obtained will be found amply sufficient. In proportion as numbers in a descending series approach very near to unity, their logarithms bear more and more exactly a constant ratio to the excess of those numbers above unity, viz. the ratio expressed by the modulus of the system, or 1 to .4342944819. As we descend in the scale, therefore, the decimal part of the exponents becoming smaller and smaller, the corresponding logarithms will approximate so nearly to the multiple of that decimal part by this modulus, that no sensible error will result from assuming them to be the same. Thus the log. of 1.05 is .021189; that of 1.005 is .0021661; and that of 1.0005 is .00021709, which differs from the product of the modulus by .0005 (or .00021715) by a quantity affecting only the 4th significant figure. The roots 1.0005, 1.00005, 1.000005, &c. may, therefore, without sensible error, be considered as coinciding with the division 217 on the slider. Hence, the divisions to the left of the lower portion of the rule may be taken as sufficiently accurate representations of the divisions which would occur in the succeeding portions of the line, if it were prolonged indefinitely in that direction.

This instrument may, from the principle of its construction, be applied to the solution of various problems in which geometrical progressions are concerned. *E. g.* As the successive amounts of a sum placed at compound interest compose a geometrical progression, all questions of compound interest are resolvable by this instrument. The rate of in-

terest, or the *per centage per annum*, being added to 1, gives the amount of 1*l.* at the end of one year. Thus, at 5 *per cent.* the amount is 1.05, at 3 *per cent.* 1.03, &c. In either case this number is to be regarded as the first term, or root of the series. Setting the unit of the slider against this number on the rule, we shall find the amount of 1*l.* at the end of $5\frac{1}{2}$ years opposite to the number 5.5 on the slider, and the same of any other interval of time. If it be required to ascertain in what time a sum placed at compound interest at 3 *per cent.* will be doubled; placing the unit over 1.03, the number 2 on the rule will indicate 23.45 on the slider, as the number of years required for doubling the sum at that rate of compound interest. The interpolation of a given number of mean proportionals between two given numbers, is sometimes required for the solution of a problem; and it is easily effected by the rule above described. Thus, in dividing the musical octave into 12 equal semitones, the following series of numbers must be calculated, viz. $2^{\frac{1}{12}}$, $2^{\frac{2}{12}}$, $2^{\frac{3}{12}}$, $2^{\frac{4}{12}}$, $2^{\frac{5}{12}}$, $2^{\frac{6}{12}}$, $2^{\frac{7}{12}}$, $2^{\frac{8}{12}}$, $2^{\frac{9}{12}}$, $2^{\frac{10}{12}}$, $2^{\frac{11}{12}}$: this may readily be done in one position of the slider; for when the 12 marked on it is placed under 2 on the rule, the 1 of the slider will point to $1.0595 = 2^{\frac{1}{12}}$, the 2 of the slider will indicate $1.1225 = 2^{\frac{2}{12}}$, the 3, $1.1892 = 2^{\frac{3}{12}}$, &c.

A variety of questions relating to the general theory of logarithms may be illustrated by this instrument. The assumption of the number 10, as the basis of our system of logarithms, is arbitrary, and chosen merely for greater convenience in computation. The hyperbolic system, whose basis is the number 2.302585093, &c. has its peculiar advantages, especially in the higher branches of analysis. The instrument may be made to exhibit at one view the series of any particular system of logarithms, that is, of a system with any given basis, or any given modulus, by merely setting the unity of the slider against the given basis on the rule, or the given modulus on the slider against the number 2.7182818, &c. on the rule. The divisions on the slider will then denote the logarithms of the numbers opposed to them on the rule.

Let it be required to determine the particular system of logarithms, in which the modulus shall be equal to the basis. Take out the slider, and introduce it in an inverted position, so that the numbers on it shall increase from right to left; and place the numbers .4343, &c. (the modulus of the common system) under 10 (its corresponding basis) on the rule, as represented in *Plate VII. fig. 9.* We shall find that, in this position, all the other numbers on the slider will be the moduli corresponding to the respective bases of each different system on the rule. Thus, the 1 on the slider, or the modulus of the hyperbolic system, is opposite to 2.718, the basis of that system. On the other hand, the division 2 on the rule is opposite to 1.4427, which is the modulus of the system having for its basis the number 2. Carrying the eye still more to the left, and observing the point where similar divisions appear, both on the rule and the slider, we shall find it to be at the number 1.76315, which therefore expresses the modulus and the basis in that particular system in which they are both equal. The reason of the above process will readily appear, when it is considered, that the modulus of every system is the reciprocal of the hyperbolic logarithm of its basis.

This inverted condition of the slider will also afford an easy method of solving exponential equations, for which there exists no direct analytical method. *E. g.* Let the root of the equation $x^x = 100$ be required. Set the unit of the inverted slider under 100 on the rule, and observe, as before, the point where similar divisions coincide: this will be at

3.6, which is a near approximation to the required root; and accordingly, $3.6^{100} = 100$.

Our author's instrument admits of being applied in various forms to the several purposes above recited, as well as to others which he has enumerated: but the following deserves particular mention, on account of the peculiarities that attend them. If to the upper scale, which we may suppose to be fixed, and to be graduated logometrically, constituting the line of exponents, a slider be adjusted, graduated on both edges, according to the logometric logarithms; and the line below, which, like the upper one, is supposed to be fixed, be graduated in the same manner as the slider, the instrument will possess the following property. When the division 10 on the slider is set against any particular number, or exponent, in the upper line, all the numbers on the lower line will be the powers, to the same degree, of the numbers opposite to them on the slider; the degree of the power being marked by the exponent on the upper line, which is above the 10 on the slider. The lower line will, therefore, exhibit the whole series of similar powers belonging to all possible roots; and conversely, the slider will exhibit all the roots of the same dimensions, with regard to all possible numbers. Thus, if the 10 on the slider be under 3 in the line of exponents, it will itself be above 1000 (which is its cube) in the lower line; all the other numbers in that line will be the cubes of their opposites on the slider; and, conversely, the former will every where be the cube-roots of the latter. This will sufficiently appear, when it is recollected that the addition or subtraction of logometric logarithms, answers to the multiplication or division of simple logarithms, and therefore to the involution and evolution of numbers. The rule in this form of it, therefore, bears a closer analogy to the common sliding-rule; since in every position it exhibits the series of similar powers and roots, exactly in the same way as the latter exhibits the series of similar products and quotients.

Dr. Roget has also contrived to give another form to the instrument, by throwing the whole scale, like Gunter's line, into a circular form: and of this form he has given a drawing. The circle on the outside being logometrically divided from 1 to 10 round the circumference, will constitute the line of exponents. The line of powers, being disposed in a spiral, will occupy the interior space, which may be made to revolve within the former, and should be provided with one or more threads, extending from the centre to the circumference, and serving as radii to mark the position of all the parts of the spiral line with regard to the divisions of the outer circle. One of these threads may be fixed at the unit or beginning of the scale, and will serve to mark the position for the root of any required power. The spiral itself must be graduated exactly as the upper line in the first described rule; that is, the situation of the division 10 must be first determined upon, and then brought under the unit in the circle of exponents; that is, under the fixed thread. Every other division must then be marked with reference to the place of its logarithm on the circle, or must be made to occupy the same angular distance from the thread. This graduation will be most conveniently made by means of the moveable leg of a sector revolving on the centre of the circle. The comparison of the divisions of the spiral with those of the circle may be made, either with this moveable sector, or with the threads already mentioned. The numbers on the spiral will increase as they recede from the centre, and each turn will carry on the powers to an exponent ten times higher than the preceding; and the converse will ob-

tain with regard to the descending portion. Thus, immediately in a line with the 10, on the superior branch of the spiral, is found the number 1000000000, or 10^{10} ; below it, on the inferior branches, we find successively $1.258926 = 10^{0.1}$, $1.023293 = 10^{0.01}$, $1.00230524 = 10^{0.001}$, $1.000230285 = 10^{0.0001}$, $1.0000230261 = 10^{0.00001}$, &c. of which the decimal figures approach nearer and nearer to 2.302585093, &c. the reciprocal of the modulus of the logarithmic system. Our ingenious author has further shewn how to exhibit in one view the whole series of roots, powers, and exponents, in all their possible relations, by a suitable disposition of lines. For further particulars we refer to the Phil. Trans. for 1815, part 1. p. 9, &c. For an account of Mr. W. Nicholson's improvements of the Gunter's scale, &c. see the Phil. Trans. for 1787, vol. lxxvii. part 2. See GUNTER'S *Line and Scale*.

SLIDING-Keels, in *Ship-Building*, an invention of the ingenious captain Schank, of the royal navy, to prevent vessels from driving to leeward. They were composed of plank of various widths, erected vertically by a winch, so as to slide up and down in a trunk, and through the keel. Many vessels were built with no less than three of these keels; but it has not seemed to have answered.

SLIDING-Planks, are the flat forms upon which the bilge-ways slide in launching the ship.

SLIDING-GUNTER-SAIL, in *Sail-Making*, a triangular sail, used in boats, bent at its foremoist leech to loops or grommets that slide on the lower mast: the peak or head is attached to a small top-mast, that slides up in the direction of the lower mast, through two hoops fixed at its head, about three feet asunder. When the top-mast is lowered, the sail furls up close to the lower mast.

SLIEBH, or **SLIABH**, the Irish name for a range of mountains, or a single one, covered with heath. O'Brien says it signifies heath-land, whether mountain or plain. It is prefixed to the names of many Irish hills.

SLIEBH-AN-ERIN, in *Geography*, a range of mountains in the county of Leitrim, Ireland, extending in a N.E. direction from Lough Allen.

SLIEBH-EN-EWR, called also *Dartry* mountains, a cluster of hills, covering almost the whole of the northern barony of the county of Leitrim, Ireland. Of these and the preceding it is observed by Dr. Beaufort, that they are far from unprofitable; for producing abundance of coarse grafs, they annually pour forth immense droves of young cattle.

SLIEVE-BAUGHT MOUNTAINS, a chain of mountains on the confines of the counties of Monaghan and Tyrone, and extending into both. They form an uninterrupted ridge of high land, the highest part of which is called Cairn-more. They have, in general, neither a fruitful soil, nor any natural beauties to recommend them, being an uninteresting waste, and almost always wet and moory. There are parts, however, which have beds of the richest limestone, and abundance of marble, particularly on the eastern side of Cairn-more. This mountain is famous for its millstone quarry; those most valued consist of a red and very hard grit or sand-stone, the grain of which is close: there is also a soft whitish sand-stone, more easily procured, but which soon wastes away. Potters' clay found in the neighbourhood is carried to the pottery at Dundalk. Stat. Ac. of Monaghan.

SLIEBH-BAUGHTA MOUNTAINS, an extensive range of rather low hills, which cover the southern part of the

the county of Galway, and the adjoining part of Clare, in Ireland.

SLIEBH-BLOOM, or **SLIE-BLOOM**, a mountain in Ireland, or rather a chain of mountains, of considerable extent, dividing the King's and Queen's counties, and extending into the county of Tipperary. It is about 25 miles in length, and, in some parts, 10 miles broad, at the base. It is very unequal in height. Some few ridges are of considerable altitude, especially those which divide Eli O Carrol from Offory. One of these is called *Ard-Erin*, i. e. the highest part of Ireland. This, however, is very doubtful, as it is probable that no accurate comparison on the subject has been ever made. Slie-bloom affords, in general, good pasturage, and in some parts, like many other Irish mountains, is green to the summit; but in other parts it is rocky, wild, and inaccessible, inasmuch that wolves are said to have found harbour in its caverns later than in any other part of the kingdom, even within the last century.

Some of the declivities of this mountain yield good corn, and are highly improved by plantations, and gentlemen's seats which command very extensive and picturesque views. It is remarkable for the number of fine rivers that spring from it. Three of these form an interesting subject to poets as well as geographers. "Near Offory," says Camden, "are those huge copling mountains named *Sliew-blamy*, which Giraldus calls *Bladinx Montes*, of a vast height, out of the bowels whereof spring three rivers, the Suire, the Nore, and the Barrow. These descend in three several channels, but join in one before they fall into the sea, which made the ancients call them the Three Sisters."

It may be observed, that the moderns likewise call them sisters, although Spenser represents them as brothers, the sons of the giant Blœmius and the nymph Rheufa, born in the mountain Sliew-bloome; and the poet thus describes their courses and final confluence.

"These three fair sons, which being thenceforth powr'd,
In three great rivers ran, and many countreis scowr'd.
The first, the gentle Shure, that, making way
By sweet Clonmel, adorns rich Waterford;
The next, the stubborn Newre, whose waters gray,
By faire Kilkenny and Rossepoite board;
The third, the goodly Barrow, which doth hoord
Great heaps of salmon in his deepe bosome:
All which, long hundred, doe at last accord
To ione in one ere to the sea they come;
So, flowing all from one, all one at last become."

Fairie Queen, book iv. canto xi.

For a more particular account of the three sisters of Slie-bloom, see **BARROW**, **NORE**, and **SUIRE**; and for a description of the foil, quarries, &c. of this mountain, see **KING'S** and **QUEEN'S Counties**.

SLIEBH-BONN MOUNTAINS, a range of mountains in the county of Roscommon, Ireland, extending nearly parallel to the Shannon, at a few miles distance, from Rusky-bridge to Lanefborough.

SLIEBH-BUY MOUNTAINS, a mountainous tract in the county of Wexford, Ireland, near the borders of Wicklow.

SLIEBH-CROOB MOUNTAINS, in the county of Down, Ireland, north of the Mourne mountains, and lying between Ballynahinch and Cattlewellan.

SLIEBH-DHAM, a mountainous range in the western part of the county of Sligo, Ireland, being part of the ridge to which Arrowsmith has given the name of *Knock-na-rec*.

SLIEBH-DONARD, one of the Mourne mountains,

in the county of Down, Ireland, said to be the highest of them, and to be 2800 feet in height. See **MOURNE**.

SLIEBH-GALLAN, a cluster of hills in the south of the county of Londonderry, Ireland; about 1250 feet above the level of the sea.

SLIEBH-GULLIEN, in the south-east of the county of Armagh, Ireland, which is thought to be nearly as high as Sliebh-Donard; and which, like it, consists of granite. It has a cairn on the summit.

SLIEBH-LEAGUE MOUNTAINS, a cluster which occupies the peninsula west of Killybegs, in the county of Donegal, Ireland; called by Arrowsmith *Slieve-long*.

SLIEBH-LOGHER MOUNTAINS, in the county of Kerry, Ireland, on the borders of the county of Cork. Spenser has represented this range as the source of the river Allow:

"Strong Allo tumbling from Sliebh-Logher steep:"

but in this he departs from geographical accuracy, as the Allow takes its rise in the Limerick mountains, and the Blackwater passes under Sliebh-Logher, from which it receives a large supply of water. See **BLACKWATER**.

SLIEBH-MISH, a range of hills south of Tralee, in the county of Kerry, Ireland.

SLIEBH-MORE, a mountain in Achil island, county of Mayo, Ireland.

SLIEBH-NA-COILTRA MOUNTAINS, a range in the county of Wexford, Ireland, south of the town of New Ross.

SLIEBH-NA-MAN, a high mountain of the county of Tipperary, Ireland, not far from the Nine-mile house, on the road from Clonmel to Kilkenny.

SLIEBH-NA-MUCK, a range of hills N. of the Galtees, in the county of Tipperary, Ireland, extending east and west, and lying southward of the town of Tipperary.

SLIEBH-RUSSEL, a mountain of the county of Cavan, Ireland, near Swanlinbar.

SLIEBH-SNAGHT, a mountain of the county of Donegal, Ireland, in the peninsula of Inishowen.

SLIGO, a county of Ireland, in the province of Connaught, bounded on the E. by the county of Leitrim, on the S. by Roscommon, on the S.W. and W. by Mayo, and on the N. by the bay of Donegal. Its greatest length, from Bunduff in the N. to the Curlew mountains in the S. is 31 Irish (39½ English) miles, and the greatest breadth 29 Irish (37 English) miles. It contains 247,150 acres, or 386 square miles, Irish measure, equal to 397,060 acres, or 620 square miles, English. The number of houses was 11,509, supposed to contain 60,000 inhabitants; but the documents on which this is stated were very imperfect, and the increase must have been inconsiderable. There are 39 parishes, of which 16 only had churches when Dr. Beaufort published his valuable work; they lie in the bishoprics of Elphin, Achonry, Killalla, and Ardagh. This county and the town of Sligo are represented in parliament by three members.

Sligo contains very good land, intermixed with large tracts of coarse and unprofitable ground. In the northern district, lying between the county of Leitrim and the sea, are the mountains of Benbulbin and Samore. A chain of rough hills extends from Lough Gilly to the bounds of Roscommon and Leitrim. The barony of Tyreragh, though level along the coast, is intersected by large bogs; and the southern part of it is bounded by the Ox mountain, Sliebh-Dham, and a great range of desolate hills, that extend across the middle of the country; whilst the Curlews

and other mountains cover much of the southern part of it. Among these hills there are many large lakes, and abundance of rivers. The Moy, which rises in the mountain of Knock-na-ree, flows first to the southward, and after a winding course, takes a northerly direction to the bay of Killalla. It receives in its course the superfluous waters of Lough Conn, and forms, for some miles, the western boundary of the county. Lough Arrow is about eight miles long, full of islands, and of a very irregular form: a river of the same name proceeds from it, and running northward to Ballyfadere, rushes at once into the sea in a stupendous cataract. Lough Garra, on the borders of Roscommon, in the most southern part of the county, communicates with Lough Key by the river Boyle, which joins the Shannon. Lough Gilly exhibits that variety of charming prospects which bold hills, wooded lawns, and large islands clothed with verdure, and crowned with trees, united with a great extent of water, cannot fail to produce. Upon the river by which the waters of this lake are discharged into the bay of Sligo, called by Arrowsmith the Garwoag, stands the town of Sligo, the only town of note in the county. There are, however, ports at Ballyfadere and Esky-bridge, at the mouths of the rivers Arrow and Esky. Hazlewood, the seat of Owen Wynne, esq. is distinguished for its beauty as well as for agricultural improvement, which has been carried here probably to a greater extent than at any other place in Ireland. The linen manufacture has made great progress in different parts of the county, especially in the vicinity of Ballymote, where it was established by the late Hon. Tho. Fitzmaurice.

SLIGO, a post-town of Ireland, chief town of the county of the same name, and a sea-port, situated at the mouth of the river which flows from Lough Gilly to the bay of Sligo. Vessels of 200 tons can come up to the quays, and the trade of Sligo has been increasing for many years. When Dr. Beaufort published, its population was estimated at upwards of 8000, the number of houses being 916. The county assizes are held here, and it sends a member to the imperial parliament. The magistrates are a provost and town-clerk. A castle was built here in 1245, and soon after a monastery, of which Mr. Archdall has said, "that the few ruins which remain evince its former splendour. Three sides of the cloister may still be seen, covered with an arched roof: the arches and pillars are of extraordinary workmanship, and a few of the pillars are ornamented with sculpture. The great east window is beautiful, and the high altar, adorned with reliefs, in the Gothic style. The nave is spacious, with a passage round it in the nature of a gallery, supported by stone pillars. This great and curious monument of antiquity seems to have fallen a prey to the devouring teeth of time, rather than to the hands of man, though Cromwell is said to have injured it." Sligo is 105 miles N.W. from Dublin.

SLIME, in *Agriculture*, a material left by the tides and other waters in different places, which is an useful manure. See OOZE.

SLINCK, or SLINGHE, in *Geography*, a river of Holland, which joins the Berchel, near Borckeloe, in the county of Zutphen.

SLINE-HEAD. See SLYME-HEAD.

SLING, FUNDA, a string instrument, serving for the casting of stones, &c. with the greater violence.

Pliny, l. lxvi. c. 5. attributes the invention of the sling to the Phœnicians; but Vegetius ascribes it to the inhabitants of the Balearic islands, now called Majorca and Minorca, who were famous in antiquity for the dexterous management of them. Florus and Strabo say, those people bore three

kinds of slings, some longer, others shorter, which they used according as their enemies were nearer or more remote. Diodorus Siculus adds, that the first served them for a head-band, the second for a girdle, and that the third they constantly carried with them in their hand.

In fight they threw large stones with such violence, that they seemed to be projected from some machine, inasmuch that no armour could resist their stroke. In besieging a town, they wounded and drove the garrison from the walls, throwing with such exactness, that they seldom missed their mark: this dexterity they acquired by constant exercise, being trained to it from their infancy, the mothers placing their daily food on the top of a pole, and giving them no more than they beat down with stones from their slings. This art is still, in some measure, preserved by the Minorquin shepherds. The invention of the sling has been erroneously ascribed by some writers to the inhabitants of these islands. Froissart (vol. i. c. 85.) gives an instance in which slings were employed for the English by the people of Brittany in a battle fought in that province during the reign of Philip de Valois, between the troops of Walter de Mauni, an English knight, and Louis d'Elpaigne, who commanded 6000 men in behalf of Charles de Blois, then competitor with the earl of Montfort for the duchy of Brittany. According to the same author, they were also used in naval combats. Slings were used in 1572, at the siege of Sancerre, by the Huguenots, in order to save their powder. D'Aubigné, who records this fact, says that they were hence called Sancerre harquebusses. Slings were constructed for throwing not only stones, but leaden bullets, and clay-balls, baked or hardened in the sun. They were made of different materials, chiefly flax, hair, or leather, woven into bands, or cut into thongs, broadest in the centre, for the reception of the stone or ball, and tapering off gradually towards both ends: with one of these slings, a good slinger would, it is said, throw a stone 600 yards. An ancient Icelandic treatise, entitled "Speculum Regale," supposed to have been written about the 12th century, mentions slings fixed to a staff.

SLING, in *Surgery*, a well-known bandage for the arm and hand.

SLINGS, in *Rigging*, short ropes used to hang the yards to the masts, &c. See SLINGING.

SLINGELANDT, PETER VAN, in *Biography*, was born at Leyden in 1640. He was a laborious disciple of Gerard Douw, and wrought in the highly finished style of that master; and is as neat in his execution. His pictures, however, do not possess the relish found in those of Gerard, either in composition or colour; and they are tasteless in design. He is said to have been most patiently persevering and industrious, employing months and years upon one performance; and never being satisfied till he found every individual part imitated, however trivial, of any object which he had chosen to represent. His works are often passed off for those of his master, and of Mieris; and it sometimes demands a considerable portion of connoisseurship to discover the imposition. He died in 1691.

SLINGER'S BAY, in *Geography*, a bay of the East Indian ocean, on the N. coast of New Ireland. S. lat. 3°. E. long. 151°.—Also, an inlet of the Pacific ocean, between the islands of Ramos and St. Juan.

SLINGING is used variously at sea; but chiefly for the hoisting up of casks, or other heavy things, with slings, *i. e.* contrivances of ropes spliced into themselves at either end, with one eye big enough to receive the cask, or any thing to be sling.

There are other slings which are made longer, and with a small eye at each end; one of which is put over the breech

breech of a piece of ordnance, and the other eye comes over the end of an iron crow, which is put into the mouth of the piece, to weigh and hoist the gun as they please.

There are also slings for the yards; which is done by binding them fast to the cross-tree aloft, and to the head of the mast, with a strong rope or chain, that if the tie should happen to break, or to be shot to pieces in fight, the yard, nevertheless, may not fall upon the hatches.

SLINGING a Man overboard, in order to stop a leak in a ship, is done thus: the man is trusted up about the middle in a piece of canvas, and a rope to keep him from sinking, with his arms at liberty, a mallet in one hand, and a plug, wrapped in oakum and well tarred in a tarpawling-clout, in the other, which he is to beat with all dispatch into the hole or leak.

SLIP, among *Ship-Builders*, denotes a place lying with a gradual descent on the banks of a river, convenient for *ship-building*; which see.

SLIPS, masses of earth which are apt to slip out of the banks of canals, reservoirs, &c.

SLIPS, in *Gardening*, such portions of plants as are slipped off from the stems or branches for the purpose of being planted out as sets. A great number of plants, both of the woody and herbaceous kinds, is propagated by slips, which is effected in the woody kinds by slipping off small young shoots from the sides of the branches, &c. with the thumb and finger, instead of cutting them off with a knife; but there is no material difference, in the success or future growth, between slips and cuttings, only the former in small young shoots is more proper to be slipped off by the hand, which, in numerous small shrubby plants, will grow; but it is more commonly practised in the lower ligneous plants, such as sage, winter-savory, hyssop, thyme, southern-wood, rosemary, rue, lavender, and others of slow shrubby growths. The best season of the year for effecting the work, is generally the spring and beginning of summer, though many sorts will grow if planted at almost any time, from the spring to the latter end of the summer, as shewn in speaking of their culture.

And in performing the work of slipping in these sorts, the young shoots of but one year's growth, and in many sorts the shoots of the year, should be chosen as growing the most readily, even when to plant the same summer they are produced, especially the hard-wooded kinds: but in the more soft-wooded plants, the slips of one year's growth will also often readily grow; being careful always to choose the moderately-growing side-shoots situated on the outward part of the plants, from three to six or eight inches long, slipping them off close to the branches, and clearing off the lower leaves; then planting them in a shady border, if in summer, and watered, or so as they can be occasionally shaded in hot sunny weather, especially small slips, inserting the whole two parts of three into the ground, giving occasional water in dry warm weather, till properly rooted; and then towards autumn, or in the spring following, transplanting them where they are to remain.

But in planting slips of the shoots of tender shrubby exotics of the greenhouse and stove, many sorts require the aid of a hot-bed or bark-bed, to promote their emitting roots more effectually, as shewn in their respective culture; but some others of the shrubby kinds, such as geraniums, will root freely in the natural earth in summer; and many of the herbaceous tribe, producing bottom-rooted offsets for slips, as aloe, &c. also readily grow, either with or without a hot-bed; but where there is the convenience of hot-beds in which to plunge the pots of slips of tender plants, it runs them off more expeditiously; and most hot-

house plants in particular require that assistance. But many shrubby plants, growing into large bunches from the root of the small under-shrubby kinds, as thyme, savory, hyssop, sage, &c. as well as those of larger growth, as roses, spiræas, raspberries, and numerous other sorts, may be slipped quite to the bottom into separate plants, each furnished with roots, and planted either in nursery-rows, or at once where they are to remain.

And as to the slipping of herbaceous plants, various sorts multiply by the roots, &c. into large bunches, which may be slipped into many separate plants, by slipping off the increased suckers or offsets of the root, and in some sorts by the offsets from the sides of the head of the plants, and in a few sorts by slips of their bottom shoots, as well as of the stalks and branches in plants of bushy growth; but the greater part by slipping the roots, as in many of the bulbous-rooted tribe, and numerous fibrous-rooted kinds of plants. The slipping of the bulbous plants is performed in summer when their leaves decay, the roots being then taken up, slipping off all the small offsets from the main bulb, which are generally soon planted again in nursery-beds for a year or two. See *BULBOUS Roots*.

In the fibrous-rooted sorts, the slipping should generally be performed in the spring or early part of autumn, which may be effected either by slipping the outside offsets with roots, as the plants stand in the ground; or more effectually, by taking the whole bunch of plants up, and slipping them into several separate parts, each slip being furnished also with roots, planting them, if small, in nursery-rows for a year, to gain strength; or such as are strong may be planted at once where they are to remain. See the culture of the different sorts under their respective heads.

SLIPPER. See *PLINTH*.

SLIPPER, a kind of iron sledge, or lock, for the use of a tram-waggon.

SLIPPER Island, in *Geography*, a small island in the East Indian sea. N. lat. 14° 8'. E. long. 93° 30'.

SLIPPER, Lady's, in *Botany*. See *CYPRIPEDIUM*.

SLIPPERY ROCK, in *Geography*, a township of America, in the state of Pennsylvania, and county of Mercer, containing 789 inhabitants.—Also, a township of Pennsylvania, in Butler county, containing 658 inhabitants.

SLIPPING, among *Gardeners*, the tearing off a sprig from a branch, or a branch from an arm of a tree. These sorts of slips take root more readily than cuttings. See *SLIPS*.

SLIPPING, in *Rural Economy*, a term used among animals to denote abortion in them. Thus, mares are said to slip their colts, ewes their lambs, and cows their calves. And it has been suggested, that cows in calf, by smelling to any flesh, particularly in a putrescent state, are affected by such a nausea as to stimulate the womb to action, and to eject the fetus: this is well known in the north of Scotland, where it is particularly guarded against. It is observed by Mr. Ross, in the 25th volume of the "Annals of Agriculture," that through the inattention of a game-keeper, there was always horse-flesh lying about his yards, and he had many cows which slipped calves. It is supposed, in the "Essex Agricultural Report," that bleeding, when one-third or half gone, is a preventative. When it happens, the abortion should be immediately buried, and the cow kept as widely apart as possible from the herd, and not receive the bull that goes with them. It is considered as certainly infectious.

And in *Suffex* it has been supposed by some that the slipping of lambs has been caused by too free a use of rape, as one large sheep-farmer, some years since, lost eighty or

ninety in this way; which was supposed to arise from feeding the ewes upon it about the end of the year, though it had been made use of before without any bad effect of this kind. The ewes in this instance had been hard kept. The same circumstance has also taken place among the flocks of other sheep-farmers. The same sort of crop has, however, been fed on the other side of the hedge at the same time with the same sort of stock without any inconvenience of this nature occurring. It is, therefore, most probably to be ascribed to some other unperceived cause. Ewes are, however, certainly, from some cause or other, very subject to slip their lambs, and of course require much care and attention in this respect. They should constantly be kept in a state of quiet, and free from all sort of disturbance for some time after the ram has been put to them.

SLIRE, in *Geography*, a town of Norway, in the province of Aggerhuus; 68 miles N.N.W. of Christiania.

SLIT, in *Agriculture*, a crack or cleft in the breasts of fat cattle, &c.

SLIT-Grafting. See ENGRAFTING.

SLIT-Planting, among planters, a mode of planting trees in small openings without the whole of the ground being dug out, a small slit or opening only being made for each tree. See PLANTING.

SLITTE, in *Geography*, a river of Scotland, which runs into the Tiviot, near Hawick, in Roxburghshire.

SLOANE, Sir HANS, in *Biography*, immortalized as the principal founder of the British Museum, was born at Killaleagh, in the county of Down, Ireland, April 16, 1660. His family is said to have been of Scottish extraction; but whatever their situation in life might be, they were desirous to acquire more honour from him, than he derived from them; though, by the education which he received, his circumstances appear to have been far from indigent. He is said to have been attached, from his youth, to the study of nature, and this led him perhaps to that of medicine, as a profession. A spitting of blood confined him at home for three years, and it was not till his 19th year that he was able to enter on a regular course of medical education at London. To this he devoted the four succeeding seasons, during which he was introduced to the acquaintance, and even the friendship, of Boyle and Ray; great names, whose continued favour affords sufficient testimony of the successful application of the young student, to the two sciences in which they respectively took the lead. Sloane proceeded to Paris, in company with Mr. Tancred Robinson; see ROBINSONIA. There he attended the lectures of Tournefort and Du Verney; and he is reported to have taken his medical degrees at Montpellier. This he could hardly have done as a Protestant, and therefore we presume another report to be more correct, of his having graduated at Orange, where possibly there might, at that time, be a sort of Protestant university. Returning to London late in 1684, Dr. Sloane became a favourite and inmate of the great Sydenham, who seems to have intended taking him by the hand as a physician. He was soon chosen a fellow of the Royal Society, and in April 1687, entered into the College of Physicians. These early advancements afford, as Dr. Pulteney remarks, the strongest presumptions in favour of his knowledge and abilities. Yet he relinquished his domestic prospects, to gratify his ardour for natural knowledge.

A desire of investigating the natural history of the West Indies, the appetite for which, among the learned of Europe, had rather been whetted than satisfied by slight and superficial information, induced Dr. Sloane to embark for Jamaica, in September 1687, as physician to the duke of Albemarle,

just then appointed governor of that island. But the death of this nobleman, on the 19th of December, soon after their arrival, putting an end to the office of his physician, the stay of the latter in the new world, which he had been so eager to visit, became abridged by his circumstances, and necessary prospects in life. He snatched fifteen months from these calls, and devoted that period, with all possible ardour, to the accomplishment of the real object of his voyage. The West Indies had hitherto been visited by Englishmen, for none but the most sordid purposes, and the passions, tastes, and characters of the settlers have generally been formed and moulded by the malignant influence of their domestic system, their luxurious habits, and the natural effects of the climate. Sloane passed through this triple ordeal untouched; for he was armed by a love of nature, a thirst for knowledge, and sufficient scientific acquirements to be sensible of the value of what he possessed, and of what lay within his reach. He made ample collections of natural history, bringing home from Jamaica, Barbadoes, Nevis, and St. Kitt's, about 800 species of dried plants, enriched with a most abundant store of information respecting their qualities and uses. He arrived in London, May 29, 1689, where he directly resumed his medical occupations, with which he happily and successfully associated his literary pursuits. A fine person, and agreeable manners, doubtless contributed more to his success as a London physician, than the skill of Hippocrates would have done by its own intrinsic worth. The interest of Dr. Sloane seems to have lain much in the city. In 1694 he became physician to Christ's hospital, and the next year he married Elizabeth, daughter of alderman Langley, who lived with him near thirty years, dying in 1724. She bore him a son and daughter, who died young; besides two daughters, who carried rich inheritances into the families of Stanley and Cadogan, and who both survived their father.—In 1693 Dr. Sloane was elected secretary to the Royal Society, which office he held for nineteen years, to the great honour and benefit of that body as well as himself, for he immediately revived the publication of its Philosophical Transactions, which had for six years been neglected. He was no less attentive to his medical duties in the College, for he projected and established a dispensary for the poor, steering skilfully through all the difficulties which usually attend any scheme for public benefit, where bodies of men are concerned. The opposition he encountered gave rise to Dr. Garth's celebrated and beautiful poem of the "Dispensary," by which alone the memory of these contests, and of most of the parties engaged, is now preserved. But it is not so with Sloane. Unfading wreaths, though not of poetic laurel, adorn his bust, and his favourite science consecrates his name in one of the most stately West Indian plants. See SLOANEA.

In 1696, the subject of our memoir published his Latin Catalogue of the Plants of Jamaica, a closely printed octavo of 232 pages. He follows Ray's system of arrangement, and is content with referring his species, as well as he could, like that great writer himself in his catalogues of British plants, to some popularly received genus; in which habit and general resemblance, rather than the structure of the fructification, are his guides. In scientific generic discrimination indeed, Sloane must yield the palm to Plumier and many others. His incompetence in this point, rendered him unfit to estimate the talents of Linnæus; when the latter visited him in 1736, and remarked to Haller, that no botanist in England, except Dillenius, understood, or cared about, generic characters. But Sloane is nevertheless entitled to rank high as a literary botanist from his uncommon attention

attention to synonyms, by which the little volume in question is rendered almost a complete *Pinax* of the plants it contains, and the history of the several species is preserved, as much as possible, from confusion. That such a work should be free from errors, is impossible, but it evinces the learning and diligence of its author. This catalogue was not followed up, till the year 1707, by the publication of the first volume of the great work, to which it was a kind of *Prodronus*, and which is entitled "A Voyage to the Islands Madera, Barbados, Nieves, St. Christopher's and Jamaica, with the Natural History of the Herbs and Trees, four-footed Beasts, Fishes, Birds, Insects, Reptiles, &c. of the last of those islands." To this volume is prefixed an introduction, of 154 pages, containing an account of the history and climate of Jamaica, the manners, domestic economy, food, trade, &c. of the inhabitants, and particularly an ample detail of their diseases. The whole is full of curious and instructive matter. The body of this volume, comprising 264 pages, 47 of which are devoted to a journal of the author's voyage, consists of descriptions of plants, with every thing that could be got together, relative to their history or qualities. The whole is illustrated by 256 plates, chiefly of plants, each plate often being occupied by several species. These were taken from the dried specimens, still extant in the author's herbarium; and are therefore very imperfect as to botanical details, though characteristic in their general appearance. It is scarcely necessary to remark that certain coloured copies which exist, are mere impositions upon the purchaser. It is more important to observe, that the genera or affinities of the plants are sometimes widely erroneous, in consequence of the work having been composed from a rather superficial inspection of dry specimens. Thus *Cardamomum minus*, *pseudo-asphodeli foliis*; *Cat.* 61; page 166. t. 103. f. 3, of the present work, is actually an *Orchidea*, of the genus *Neottia*; whilst *Orchis elatior latifolia*, *asphodeli radice*, *spicâ strigosa*; *Cat.* 119; p. 250. t. 147. f. 2, is, according to the herbarium, an *Alpinia*. The figure however represents an *Orchidea*.

The statistical part of this book is valuable, but there are some remarks relative to the management of slaves, which we cannot pass over, especially as the question of the slave-trade still calls for all the vigilance of the Christian moralist and politician, to defeat the machinations of its advocates, and secret promoters. The following, amongst others, are Sloane's words. "The punishments for crimes of slaves, are usually for rebellions burning them, by nailing them down on the ground with crooked sticks on every limb, and then applying the fire by degrees from the feet and hands, burning them gradually up to the head, whereby their pains are extravagant. For crimes of a lesser nature, gelding, or chopping off half of the foot with an axe. These punishments are suffered by them with great constancy." The author proceeds as coolly to describe "usual" whipping and other punishments, and concludes thus. "After they are whip'd till they are raw, some put on their skins pepper and salt, to make them smart; at other times their masters will drop melted wax on their skins, and use several very exquisite torments. These punishments are sometimes merited by the blacks, who are a very perverse generation of people; and though they appear harsh, yet are scarce equal to some of their crimes, and inferior to what punishments other European nations inflict on their slaves in the East Indies, as may be seen by Moquet, and other travellers." The author, in palliating these enormities, worthy of Spanish inquisitors, and perhaps originally derived from some such hellish source, does not inform us whether our Christian Protestant ministers preached against them; but we learn

from other documents that they durst not. We know also that the parent state, ecclesiastical as well as civil, for ages looked on, without interfering; and even at this moment, all the strenuous exertions of the virtuous few, supported by the awakened zeal of most Christian divines, of every persuasion, are scarcely able to succeed in demolishing the root of the evil. Regulations have indeed been made to guard against some of the above enormities, and the African slave-trade has been abolished by law. But let Britons never forget that such things have existed, and guard, with all their power and vigilance, against a possibility of their return. The coolness or partiality of Sloane, only proves the callous state of the public mind respecting this question, upon which he tried to make himself as easy as he could. He was, on the whole, a man of good feelings, charitable to the poor, alive to their interests wherever they came in his way, and friendly to all improvements in his profession; such as inoculation for the small-pox, and the use of the Peruvian bark; both which were combated in his day, even more absurdly, and no less dishonestly, than vaccination is at present.

The second volume of Sloane's Jamaica did not appear till the year 1725. By some accident, this is much the most common of the two, and frequently sells for a trifle, while both together fetch about twelve guineas. Of this second volume, 187 pages are devoted to the vegetable, and 148 to the animal, kingdom. There is besides a copious index of 102 pages. About 80 of the plates relate to plants, and 42 to animals. A short account is given of the author's return to England, with the dowager duchess of Albemarle; and numerous corrections, or additions, to the first volume are subjoined. The author frequently refutes his antagonist Plukenet in a decisive style, but with less acrimony than the latter has usually betrayed. It would be tedious and unprofitable to follow them through all the mazes of their criticism, but as far as we have incidentally done this, Plukenet is generally most exact. (See PLUKENET.) We must not omit to notice, that Sloane liberally allowed Ray to make use of his Jamaica manuscripts, in the third volume of the *Historia Plantarum*, where the original generic distributions of the author, if they merit that appellation, are followed. Though Sloane tells us, in the preface to his first volume, that some of the plants, with his observations upon them, had received the approbation of his illustrious friend; it does not any where appear that questions of botanical arrangement, or technical discrimination, had been particularly discussed between them. We must not therefore lay any defects of this kind to the charge of Ray, to whom the scientific botany of the West Indies was nearly an unexplored field, of which Sloane furnished him by no means with sufficient materials for the cultivation; the latter having examined nothing very deeply in this respect, and his dried specimens being mollly insufficient for the purpose.

The collections of natural history, made by Sloane in his voyage, seem to have laid the foundation of that museum, which became gradually so famous. A brother collector and friend, Mr. Courten, in 1702, left his own acquisitions to augment it, on condition of the payment of certain debts and legacies, to an amount much below the value of what was thus bequeathed. How soon curiosities of art were included in Dr. Sloane's museum, or whether such made a part of Mr. Courten's, we know not; but the whole collection was now very considerable, and continued increasing during the long life of its owner, who, the year before he died, reckoned up the articles of natural history, exclusive of 200 volumes of dried plants, as amounting to more than

30,600. His taste or collecting was followed by many persons, nor should his humble imitator, Mr. Salter of Chelsea, the founder of the well-known Don Saltero's coffee-house, be altogether despised. Who can answer for the taste or curiosity that may have been awakened by this humble popular museum, or the pursuits and discoveries to which it may have led? The writer of this is not ashamed to acknowledge his own obligations to it at a very early period. The discoveries of Sloane in the West Indies were moreover useful, in exciting collectors of living plants to enrich their gardens from that novel and fertile source, by which all the hot-houses in Europe profited. Hence the French were led to send out PLUMIER, see that article; and though at war with England in the year 1708, that nation was generous enough to admit the subject of our memoir, with the permission of queen Anne, as one of the eight foreign members of the *Academie des Sciences*. His honours and appointments at home were rapidly increasing. He was consulted by the royal family, and created a baronet by king George I. This rank, it is said, had never before been conferred on a physician; though such an application of it has since been frequent; as being easier to the giver, and more advantageous to the receiver, than more solid, but less brilliant, rewards for court service. Sir Hans became physician-general to the army, and in 1719 was elected president of the College of Physicians, which station he held for sixteen years; but all his other honours fade before that of the presidency of the Royal Society, conferred upon him, on the death of sir Isaac Newton, in 1727. He resigned the latter, at the age of fourscore, in 1740, when he retired to the manor-house of Chelsea, which manor he had purchased about the year 1720. Here he received the visits of his scientific and other friends, patronized the ingenious, and assuaged the distressed. The worthy George Edwards records, in his *Essays on Natural History*, that he seldom missed drinking coffee with "the good sir Hans Sloane" on a Saturday, during his retirement of about fourteen years at Chelsea. "He was so infirm as to be wholly confined to his house, except sometimes, though rarely, taking a little air, in his garden, in a wheeled chair." Edwards unexpectedly found him in the agonies of death, on the 10th of January, 1753, N.S. at four in the afternoon. He expired at four the next morning, in the 92d year of his age, and was buried, along with his lady, in a vault, at the south-east corner of Chelsea church-yard, where a handsome, and very conspicuous, monument to his memory still exists. His epitaph relates that he died "without the least pain of body, and with a conscious serenity of mind." Edwards says, "I continued with him later than any one of his relations, but was obliged to retire, his last agonies being beyond what I could bear; though under his pain and weakness of body, he seemed to retain a great firmness of mind, and resignation to the will of God." These accounts may not be totally irreconcilable. The convulsions of death are "agonies" probably in appearance more than reality; and it is consolatory to see a well-directed mind, even in ordinary cases, generally superior to them, in a remarkable manner. Sloane was, in every respect, prepared to meet them.

The person of sir Hans Sloane was tall and handsome; his manners easy, polite and cheerful. He delighted in exhibiting and explaining to strangers, and especially foreigners, whatever he possessed, and is said to have kept an open table once a-week, for his friends, particularly such as belonged to the Royal Society. That his reception of the great Linnæus was not peculiarly flattering, has often been mentioned with regret; nor can we account for it otherwise, than by recollecting that he was not sufficiently

gifted with the talismanic power of genius, by which kindred minds discover each other, through every disguise of rank, or external appearance. But the principal obstacle to the free intercourse of these distinguished men arose, perhaps, from the want of a common language. Linnæus could speak nothing but Latin, and that with the foreign accent. He was moreover, at this time, full of those novel ideas of botanical philosophy, by which he subsequently gave laws to the learned world. Boerhaave, who recommended him with enthusiasm to Sloane, could appreciate these; but to the latter, as at first sight to Dillenius, they promised nothing but confusion and inconvenience; and though the Oxford professor soon looked further into their merits; the opulent patron and collector, who had risen to eminence by his own means, felt no inclination to go to school to a poor Swedish student, hardly superior in his eyes to a working gardener. Few men can be serviceable in many different ways. The merits of sir Hans Sloane were transcendent in his own line. He neglected no means, that appeared to him eligible, for promoting literature or science. On purchasing his great estate at Chelsea, he presented the Apothecaries' company with the fee simple of the garden which they had already made there, on a condition, equally beneficial to their fame and to science, that it should for ever continue a *botanic garden*. "He was governor," says Dr. Pulteney, "of almost every hospital in London; and to each, after having given an hundred pounds in his life-time, he left a more considerable legacy at his death. He was ever a benefactor to the poor, who felt the consequences of his death severely. He was zealous in promoting the establishment of the colony of Georgia, in 1732; and formed, himself, the plan for bringing up the children in the Foundling Hospital, in 1739."

Nor was the pen of this active philosopher idle, amid his other occupations. To particularize even the titles of his papers, printed by the Royal Society, amounting to 35, would lead us too far. However curious and useful the contents of most of the rest may be, the last in the list, on Inoculation, vol. 49. 516, is pre-eminently important, as recording the introduction of that practice into England, and displaying the candour, as well as good sense, of the writer, in every thing relative to the subject.

It remains for us only to mention the establishment of the British Museum, for which the nation is entirely obliged to sir Hans Sloane. He bequeathed it to the public, on condition of a payment, to his heirs, of 20,000 pounds; a sum said barely to equal the intrinsic value of the precious metals and gems, of the medals and mineral specimens. Besides the abundance of natural and artificial curiosities, his library, amounting to 50,000 volumes, of books and manuscripts, was included in the bequest. In collecting these books, he is reported to have sent his duplicates, either to the College of Physicians, or the Bodleian library. Parliament having accepted the legacy of Sloane, augmented it with the library of sir Robert Cotton, and the valuable manuscripts of the lord treasurer HARLEY; see that article. The whole, with various additions, has been deposited in the vast and massy palace of Montagu House, where it is now, in the most easy manner, and free of expence, accessible to the public. Two of the founder's descendants are always hereditary trustees of these treasures, associated by the original act of parliament, or by particular election, with a limited number of the most eminent men in the kingdom. For the present state of this noble repository, and its more particular history, see MUSEUM, *Britisb*. Sloane's Works. Pulteney's Sketches of Botany. Aikin's Gen. Biog. S.

SLOANEA, in *Botany*, so named by Plumier, in honour of his celebrated predecessor in the botanical investigation of the West Indies, Sir HANS SLOANE. (See that article.)—Linn. Gen. 265. Schreb. 353. Willd. Sp. Pl. v. 2. 1155. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 3. 296. Swartz Obf. 212. Juss. 291. Lamarck Illustr. t. 469. (Sloana; Plum. Gen. 48. t. 15.)—Class and order, *Polyandria Monogynia*. Nat. Ord. *Amentaceae*? Linn. *Tiliaceae*, Juss.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, in five, or more, acute, rather unequal, segments. *Cor.* none. *Stam.* Filaments very numerous, above 100, short, inserted into the downy, fleshy receptacle; anthers oblong, of two cells, attached lengthwise to the filaments. *Pist.* Germen superior, roundish, angular; style simple, awl-shaped, longer than the stamens; stigma nearly simple. *Peric.* Capsule large, roundish, prickly, of from three to six valves, and as many cells, bursting at the top, the partitions from the middle of each valve. *Seeds* two or three in each cell, oblong, obtuse, involved in a pulpy tunic.

Ess. Ch. Corolla none. Calyx of one leaf, inferior, in five or more segments. Anthers attached longitudinally to the filaments. Capsule prickly, of from three to six valves, and as many cells. Seeds two, with a pulpy tunic.

Obf. Linnæus seems to have been led by the very erroneous opinion of Miller, (who referred this genus to *Castanea* or *Fagus*;) to consider it as probably of his amentaceous order. Jussieu has far more correctly ranged it with his own genuine *Tiliaceae*, near *Sparrmannia*. Three species are now known; five South American, or West Indian, trees, of which Linnæus was acquainted with the first only. His *S. emarginata*, Sp. Pl. 731, taken up from Catesby's work, without the inspection of any specimen, is, as Willdenow remarks, no other than *Achras Sapota*. Concerning the rest, great confusion, originating with Aublet, is perpetuated by no less authority than that of Swartz, followed by Willdenow and Aiton. Jussieu also errs in supposing the Linnaean *Sloanea* to be *Aubletia*, or *Apiciba*. Such may indeed be the plant of the *Hortus Cliffortianus*, but that of *Sp. Pl.* is certainly Plumier's. We shall attempt a corrected view of the species and their synonyms, from authentic specimens.

1. *S. dentata*. Chestnut-leaved Sloanea. Linn. Sp. Pl. 730. Ait. n. 1. (S. Massoni; Swartz Ind. Occ. 938. Willd. n. 2. Sloana amplis caltanæ foliis, fructu echinato; Plum. Ic. 240. t. 244. f. 1.)—Leaves toothed; heart-shaped at the base. Stipulas linear, serrated. Calyx deeply divided.—Native of South America and the West Indies. Our specimens were gathered by Masson in the island of St. Kitt's. Miller is said to have cultivated this plant in the stove at Chelsea, but it has not been known to blossom in Europe. In its native country this is a lofty tree, with round leafy branches, finely downy when young. Leaves alternate, stalked, a foot or more in length, and half as broad, smooth, with one rib and many strong transverse veins, rather coriaceous; more or less heart-shaped at the base; the margin distantly and rather slightly toothed. Footstalks downy, two or three inches long. Stipulas near an inch in length, narrow, deeply toothed, almost pinnatifid, situated in pairs at the base of each footstalk. Clusters axillary, towards the ends of the branches, compound, many-flowered, drooping, not half so long as the leaves. Flowers green, about three-quarters of an inch wide, conspicuous for their numerous tufted stamens. Anthers, as well as germen, hairy. Capsule woody, above an inch in diameter, clothed with very long, rigid bristles, spreading in all directions.

2. *S. grandiflora*. Large-flowered Sloanea. (*S. dentata*; Swartz Obf. 213. Willd. n. 1, excluding the synonyms, except the following. *S. Plumierii*; Aubl. Guian. v. 1. 536.)—Leaves toothed; tapering at the base. Stipulas triangular-heart-shaped, serrated. Calyx with shallow segments.—Gathered in the forests of Guiana by Aublet, whose specimen is before us. He found it bearing flowers and fruit in November. The trunk is forty or fifty feet high, and two in diameter. Leaves pointed at each end. Stipulas very broad at the base, and more slightly serrated or toothed. Flowers almost twice as large as those of the preceding; the calyx remarkably and essentially different, having a broad, hemispherical, cup-like base, and very wide shallow segments in the border; whereas the *dentata* has a calyx divided nearly to the base, into lanceolate, or somewhat ovate, taper-pointed lobes. Capsule of from three to five cells. Seeds one, two, or three in each cell, enclosed in a red succulent tunic. The specific character and description given by professor Swartz, cannot be mistaken; but it is remarkable that he should not have detected Aublet's misapplication of Plumier's synonym. This error is indeed the more pardonable in Aublet, as he was acquainted with but one of these two species, and took it, of course, for what Plumier had figured.

3. *S. Aubletii*. Small-flowered Sloanea. Swartz Ind. Occ. 940. (*S. sinemariensis*; Aubl. Guian. v. 1. 534. t. 212. Willd. n. 3.)—Leaves roundish, abrupt, entire. Calyx in five deep ovate segments.—Gathered by Aublet in the forests of Guiana about the river Sinemari, 30 leagues above its mouth, bearing flowers and fruit in November. Swartz says it was found by Masson in St. Kitt's. The trunk is described as forty or fifty feet high, with a reddish, cracked, and wrinkled bark. Branches slender, finely downy when young. Leaves in Aublet's specimen near a foot long, on stalks about one-third that length, coriaceous, smooth, strongly veined. He describes the stipulas as being long, broad, and pointed. These we have not seen, any more than the flowers, which grow in short, simple, axillary clusters, and are much smaller than either of the preceding. The style in Aublet's plate, as well as his own French description, is represented divided into four or five deep slender segments. The capsule is oblong, an inch in length, with four or five cells and as many angles, clothed with long, slender, ascending filaments or bristles. We should gladly have given the name of *parviflora* to this species, but we have taken the least exceptionable of those that already exist. The *Galibis* call this tree *Oulouqua-Palou*, but nothing is recorded of their applying it to any use.

SLOATH, or **SLOTH**, in *Zoology*, the name of an animal remarkable for its slow motion. Of this animal there are two species. See **BRADYPUS**.

The *three-toed* sloth has a blunt black nose, a little lengthened; very small external ears; small, black, and heavy eyes, with a dusky line from the corner of each; the colour of the face and throat a dirty white; hair on the limbs and body long, and very uneven, of a cinereous brown colour, with a black line along the middle of the back; each side, about the shoulders, is dashed with rust colour; the rest of the back and limbs spotted irregularly with black; the tail short; legs thick, long, and awkwardly placed; the face naked; and three very long claws on each foot. Pennant.

This creature, which grows to the bulk of a middle-sized fox, is so very tedious in all its motions, that it will be three or four days in climbing up, and coming down a tree, and does not go the length of fifty paces upon even ground in a day. It never kills till compelled by hunger: its food is fruit, or the leaves of trees. Its motion is attended with a

very moving and plaintive cry, so that beasts of prey avoid it with horror.

The sound of its voice seems only to express the word *hau*, for which reason the Brazilians call him by that name; but he usually repeats the sound about six times together, descending, as if one should sing *la, fol, fa, mi, re, ut*.

Its look is so piteous as to move compassion, and accompanied with tears. Whatever he takes hold of, he does it so strongly, or rather so stiffly, that he will sometimes sleep securely while he hangs at it.

Clusius, Marcgrave, Piso, and others, have given descriptions of this animal, but they none of them mention the length of his fore-feet; which, according to the animal preserved in the Museum of the Royal Society of London, is double that of the hinder pair.

From the shag of his body, the shape of his legs, and his having little or no tail, as also from the slowness of his gait, and his climbing up trees as little bears use to do, he seems to come near the bear-kind, from which he differs chiefly in having but three claws upon a foot.

This creature breeds principally in Florida and Brasil. Grew's Mus. p. 11.

The *two-toed* sloth has a round head; short projecting nose; ears like the human; two long strong claws on the fore-feet, and three on the hinder; long and rough hair on the body, in some parts curled and woolly; in some, of a pale red above, and cinereous below; in others, of a yellowish-white below, cinereous-brown above; it has no tail. This animal inhabits South America, and the island of Ceylon. Pennant.

SLOATS of a Cart, the under pieces which keep the bottom of the cart together.

SLOB-FURROWING, in *Agriculture*, a particular method of ploughing land.

SLOBNA, in *Geography*, a town of the duchy of Warsaw; 25 miles S. of Kalish.

SLOBNICK, a town of the duchy of Warsaw; 24 miles N.N.W. of Posen.

SLOBODSKAIA, a fortress of Russia, in the government of Ekaterinoflav; 64 miles N.E. of Ekaterinoflav.

SLOBODSKOI, a town of Russia, in the government of Viatka; 20 miles N.N.E. of Viatka. N. lat. 58° 40'. E. long. 50° 44'.

SLOD'TZ, RENÈ MICHAEL, in *Biography*, surnamed Michael Angelo, a sculptor, was born at Paris in 1705. He studied under his father, who was a native of Antwerp, after which he went to Rome, and upon his return was admitted a member of the Academy of Paris, where he died in 1764. One of his most considerable works is the monument of Languet, in the church of St. Sulpice.

SLOE, *Prunus Sylvestris*, the English name for the wild plum. See PRUNUS.

The juice expressed from the fruit of the sloe-bush while unripe, inspissated by a gentle heat to dryness, is called German acacia. It differs from the Egyptian molt remarkably in this property, that it gives out its astringency in good measure to rectified spirit as well as to water, whereas that of the other is not at all dissoluble in spirit.

A conserve of this fruit has been prepared in the shops, by mixing the pulp, pressed out through a sieve after the sloes have been steeped in water over the fire, till they are sufficiently soft without bursting, with thrice its weight of double refined sugar.

In some places, the unripe sloes are dried in an oven, and then fermented with wines or malt liquors, for a restraining diet drink in alvine and uterine laxities. The bark, both of the branches and roots, is said to be successfully given in

intermitting fevers, and it has been recommended by some as equal to the Peruvian bark. It is apparently a strong styptic. The watery infusion of the flowers, sweetened with sugar, or made into a syrup, is said to be a very useful purgative for children. Lewis's Mat. Med.

SLOE-Worm, in *Natural History*, the name of an insect found on the leaves of the sloe, or black-thorn, and sometimes on those of the garden plum.

This, and a like worm, found on the leaves of the oak, both remarkable for the hairs which cover them, each of which is forked, or divided into two at the ends, are usually esteemed caterpillars, but they are in reality animals of a very different class: the caterpillar has, at the utmost, but sixteen legs; these have twenty-two, and have all the other characters of that class of insects called by the French naturalists *fausses chenilles*, or bastard caterpillars.

All the animals of that class are very remarkable for the different figure they make after the last change of their skins; but this is in none seen so obviously, as in these two species: that of the oak is of a greenish colour, and its hairs, which are so stiff that they almost deserve the name of spines, are black; that of the sloe is of a greyish hue, and its spines longer, and of a deep brown: every one of these is, towards the extremity, divided into two, in the manner of the tines of a fork. These give the animal a very remarkable figure, and are cast off with the several skins, while the new skins have others in their place; but in the last change, before that into the nymph state, the change made in the creature is such, that it could never be suspected to be the same animal by any one, who was not an eye-witness of the change.

The creature in this, throwing off its skin, becomes perfectly smooth, and of a dirty yellowish colour, with not the slightest variegation on it, nor the least appearance even of the remains of the spines. In this state it remains till it goes into the nymph state; and from that, after about sixteen days, it comes out in the shape of a four-winged fly. The whole process of the change is the same, in the two species of the oak and the sloe; but the flies they produce are very different. Reaumur's Hist. Inf. vol. ix. p. 119. See PRUNUS, in *Gardening*.

SLOKUM'S ISLAND, in *Geography*, a small island in Barnstable bay, near the coast of Massachusetts.

SLOMIGRODEK, a town of Austrian Poland, in Galicia; 20 miles W. of Lemberg.

SLONEK, a town of the duchy of Warsaw, on the Vistula; 15 miles N.W. of Ploczk.

SLONIM, a town of Lithuania, in the palatinate of Novogrodek; 32 miles S.S.W. of Novogrodek.

SLONITZ, a town of Bohemia, in the circle of Schlan; 4 miles S. of Seblan.

SLOOP, in *Sea-Language*, a small vessel furnished with one mast, the main-sail of which is attached to a gaff above, to the mast on its foremost edge, and to a long boom below; by which it is occasionally shifted to either quarter.

Sloops, smacks, barges, and lighters, that pass through bridges, have the mast confined in a trunk or wooden cup, above the deck, and fastened in by an iron strap on the aft-side. Some have a strong iron hinge at the heel of the mast, or a bolt through the heel; so that it can be lowered at pleasure, by the stay-tackle easing away the fall by degrees. To raise the mast, the fall is brought to the windlafs, and hove upon, until the mast is up in its place: the fall is then stopped to the windlafs bits.

Dutch sloops are small vessels, used upon the canals in Holland, with one mast, on which are hoisted a sprit-sail and a fore-sail, set close to the stem. There are many fishing-

fishing-boats in Holland, rigged in the same way, with the addition of a bow-sprit and jib, and they are there called "pinks." Their sails are generally tanned.

SLOOP of War, is a name given to the smallest vessels of war, except cutters. They are rigged either as ships or snows. See **RATE** and **SHIP**.

SLOOTEN, or **SLOTEN**, in *Geography*, a town of Holland, in the department of Friesland, capital of Westergoe, near a large lake called Slooter-Meer. Its fortifications, constructed by the confederates, and afterwards destroyed by the Spaniards, have been enlarged by the states of the province, and defended by five bastions. The magistracy is composed of four burgo-masters and three senators; 10 miles E. of Bolswaert. N. lat. $52^{\circ} 55'$. E. long. $5^{\circ} 35'$.

SLOP, STREET, in *Agriculture*, that sort of moist sloppy substance, which is raked, swept, and shovelled up from the streets of large towns, for use as manure. It is a kind of material which is much made use of in this way, in the vicinity of the metropolis, in the neighbourhood of Manchester, and of several other places, where it is collected in large quantities. Near the first of these places the barge-men on the river are said, in the agricultural report of the county, to convey to and deliver the slop of the streets at any distance which is capable of being reached in one tide, at the price of about four guineas for seventeen or eighteen cart-loads, each load consisting of nearly two tons weight. This is called *cold* manure, in contradistinction to that of the stable littery sort, which is denominated *hot* manure, and delivered at the expence of one guinea more.

Slop of this kind is also sent from the different wharfs, by the barges, on the river Lea canal, which carry about thirty tons, or fifteen cart-loads; and delivered, as far as the towns and villages at about thirteen miles distance, for four pounds.

At Manchester, the value of this sort of manure, from almost nothing, has increased to a very considerable sum, in the course of the last twenty-five years.

Most other large towns might afford vast supplies of manure of this nature, and be of great advantage to agriculture; while, at the same time, they would derive an increased revenue from it. At present much neglect takes place in this respect, in many places. See **MANURE**.

SLOPAN, in *Geography*, a town of Poland, in Volhynia; 52 miles N.E. of Lucko.

SLOPE-HOLES, in *Canals*, are holes or marks made in the points E and L (*Plate I. Canals, figs. 14 and 15.*), to direct the navigators, or workmen, where to begin to cut or dig the sides of a canal.

SLOPES, are such parts of the ground as have been dug or left sloping, as GI and KP (*Plate I. Canals, figs. 3 and 6.*) Some also denominate the sides of the canal, as CB and HI, (*figs. 14. and 15.*) the slopes.

SLOPING ALLEY. See **ALLEY**.

SLOPING Banks, in *Rural Economy*, the shelving borders of rivers and sea-shores, which are highly useful and necessary for securing and protecting them against strong floods and tides. The more slow and gradual such slopes are made, the more beneficial they will be in giving safety to such banks. See **RIVER-Banks**, **Securing of**, and **EMBANKMENT**.

SLOP-ROOM, in *Ship-Building*, an apartment on the orlop, appointed for the purser to keep the ship's slops in.

SLOT, in *Agriculture*, a term used to signify any broad, flat, wooden bar.

SLOT, in the *Sportsman's Language*, a term used to express the mark of the foot of a stag, or other creature proper for the chase, in the clay or earth, by which they

are able to guess how long the creature has been gone by, and which way he went. The slot, or treading of the stag, is very nicely studied on this occasion. If the slot be large, deep printed in the ground, and with an open cleft, and, added to these marks, there is a large space between mark and mark, it is certain that the stag is an old one. If there be observed the slots, or treadings of two, the one long, and the other round, and both of one size, the long slot is always that of the larger beast.

There is also another way of knowing the old ones from the young ones by the treading; which is, that the hinder feet of the old ones never reach to their fore-feet, whereas those of the young ones do.

Old stags also are long-jointed, and they never tread double or falsely, as the young ones do, because the tendons, that hold the joints of their feet, are stronger; but the feet of the young ones are sometimes forced, for want of these strong sinews, to turn away double.

It is to be observed also, that there is a great difference between the slot of a stag or hart, and that of a hind; for there is no hart of the second head so young, but that he leaves a larger and wider slot than the hind, excepting when the hinds are big with young, for on that occasion their claws will open as wide as those of the hart.

Another method of knowing the age of a stag is by his fumets, though some general rules are to be known, before any thing can be judged from this article. These are, that in April and May they cast their fumets as it were in cakes; and in June and July they cast them in thin, long, and large crotels; and from thence to the end of August they hold the same form and size; but they are in this last month always hard and knotty. In all these cases, the largest and longest fumets are esteemed to be the marks of the largest and oldest stags. If they have been disturbed, or if they have received any hurt, they usually cast them sharp at one end, and dry. This also is constantly the case, when their new horns are just grown to their hardness, and they rub them against the trees to get off the cracked membranes, which were the velvetings in their first state.

There is always also a difference between the fumets of the morning and those of the evening: those made at night, when they go to relief, are better digested, and consequently moister than those made in the morning; because having taken their rest all day, there is a more perfect digestion made than can be in the night, as they are, during that time, seeking food.

There are also several other ways of judging of the growth and size of a stag, as by his carriage, or bearings, according to the huntsman's phrase; that is, according to the breaking of the tender branches of trees which he makes with his horns in passing through. When the boughs are found bruised and broken very high, and to a good width, there is no doubt of his being an old one; but this judgment is not to be made in the months of March, April, May, and June, because their horns are at that time either wholly wanting, or they are young and velvety. The height of the creature's entries into the woods is also another mark of his size; for the old ones are always proud and stately, and go in erect, but the young ones will creep.

The older the stag is, the sooner he goes to fray, and the larger are the trees he chooses for this use; the young ones go later into it, and always choose the weaker and lower trees. Notwithstanding that, after the sixth year, the age is not certainly known by the horns, as there is, after this time, no increase in the number of their branches; yet a probable guess may be made from their being all thicker and more robust, and the tops more open.

SLOT, *Drawing on the*. See DRAWING.

SLOTH, in *Zoology*. See SLOATH.

SLOUGEA, in *Geography*, a town of Tunis, on the north side of the Mejerdah; 12 miles N.E. of Tuberkfoke.

SLOUGH, a hamlet in the parishes of Upton and Stoke Poges, and hundred of Stoke, county of Buckingham, England, is 21 miles W. from London, and 1 mile N. of Eton. This place is feated on the great western road, and has long been the residence of Dr. Herschel, the celebrated astronomer, who manufactured here some of the largest reflected telescopes ever known. One of these, forty feet in length, still remains in the garden attached to his house; and by the use of this very powerful instrument, the doctor has made several important discoveries in the planetary system. A particular account of this telescope, with eighteen engravings, is published in the *Philosophical Transactions for 1795*. *Beauties of England*, vol. i. by J. Britton and E. W. Brayley, 1801. *Lyfons's Magna Britannia*, vol. i. 4to.

SLOUGH, a deep rut or hole in a road or carriage-way. The cast skin of a snake, the damp of a coal-pit, and the scar of a wound, are also called by the same appellation.

SLOUGH of a wild Boar, is the bed, soil, or mire, in which he wallows, or in which he lies in the day-time.

SLOUGH-Silver, in *Old Writers*, a rent paid in some places in lieu of certain days work in harvest, heretofore reserved to the lord from his tenants.

SLOUTH, or SLOUGHT, in *Hunting*, is used for a company of some sorts of wild beasts: as, a slouth of bears.

SLOW FEVERS. See FEVER.

SLOW Pulse. See PULSE.

SLOW-Worm, the English name of the *cacilia*, or *anguis fragilis* of Linnæus, called also the *blind-worm*, and by some the *deaf adder*, which, in the Linnæan system, is a species of the *anguis* or snake; the *cacilia* being a distinct genus of serpents. See SERPENTES.

It is distinguished from all our snakes by its smallness, and by the shape of its tail, which runs out a great way beyond the anus, and yet is blunt and considerably thick at the end.

The colour of the back is cinerous, marked with small lines composed of minute black specks; the sides are of a reddish cast; the belly dusky; both marked like the back; the tongue is broad and forky; the teeth small, but numerous, and the scales small. It is slow in its motion, and inoffensive in its nature.

These snakes lie torpid in the winter, and are sometimes found in vast numbers twined together.

It resembles the viper in its manner of producing its young, which are brought forth alive.

Dale, from Gesner, gives an account of theriaca being prepared of this serpent and treacle water, for a sudorific in the plague. James.

SLUCH, or SLUTCH, in *Agriculture*, a term often applied to signify a soft liquid muddy sort of material, found in different situations where water stagnates.

SLUCHAU, or TSHLUCHOW, in *Geography*, a town of Prussian Pomerelia; 44 miles S.S.W. of Dantzic.

SLUCK, or SLUCKZ, a town of Lithuania, in the palatinate of Novogrodek, in which are three Greek churches, one for Roman Catholics, one for Lutherans, and one for Calvinists; 68 miles E.S.E. of Novogrodek. N. lat. 52° 50'. E. long. 27° 33'.

SLUDGE, in *Agriculture*. See SLUSS.

SLUDKA, in *Geography*, a town of Russia, in the government of Perm; 8 miles S. of Obvinsk.

SLUDS, a term used by the miners in Cornwall for half-roasted ores.

SLUE, *To*, is to turn any cylindrical or conical piece of timber about its axis, without removing it. This term, in sea-language, is generally applied to the movement by which a mast or boom is turned about, in its cap or boom-iron.

SLUG. See LIMAX.

SLUG, in *Agriculture and Gardening*, a destructive animal of the snail kind, which is highly mischievous in the field, as well as the garden, by eating off the young stems of tender plants. There are several different kinds of these little animals. The white and brown leathery kind often even destroy the strong stems of young cabbage, and other similar plants. The destruction of them has been suggested to be effected by the use of tar-water, sprinkled over the ground; and also by having recourse to lime, in the preparation of the land for such crops. They conceal themselves in the holes and crevices, only making their appearance early in mornings and late in the evenings. The white slug or snail is likewise very destructive to young turnip crops, by riling out of the holes of the soils, on wet and dewy mornings and evenings. Rolling the ground with a heavy implement, before the sun rises, has been advised as a means of destroying them in these cases.

Slugs of this sort are likewise very destructive, in some districts, to the roots of corn crops, during the day-time, in the early spring months, while they lie concealed in the ground, by eating and devouring them; and by coming out in the evenings, and during the night-time, to commit ravages on the blades, and other parts above the ground. Numbers of them are sometimes met with upon the same plant, and they may easily be extirpated and removed from the land by the above practice, while they are at work, especially in moon-light seasons, and any further injury to the crops be guarded against. Warm moist weather is always a great encouragement to their coming out of their hiding-places; and advantage should constantly be taken of it for their extermination, as they suddenly retire under ground during the time of cold.

The strong lands of other places are occasionally much infested with them in the pea, bean, and rye crops and stubbles, as well as clover roots, when a wheat crop is put in upon them. The slugs, in some cases, are of about half an inch in length, having their backs of a blueish cast in the skin part, and their under parts wholly of a white appearance.

A mixture of sulphur and lime, made so as to be conveniently applied, has been found to be highly destructive of slugs in general.

The use of lime-water has lately been advised as an excellent and cheap mode of destroying slugs in gardens, as well as fields, in the second volume of the *Transactions of the Horticultural Society of London*. It is found to be far preferable, in this intention, to quick-lime, which is liable to become too soon saturated with moisture, and rendered ineffectual. The manner of employing the water is after it has been newly made from stone lime, by means of hot water poured upon it, to pour it through the fine rose of a watering-pot over the slugs, which have been collected by means of pea-haulm, or some other similar substance, laid down on the ground in portions, at the distance of about a pole from each other. In proper weather, the slugs soon collect in this way, in great numbers, for shelter as well as to get food. When a boy takes up the substance, and by a gentle shake leaves the whole of the slugs on the ground, another person then pours a small quantity

of lime-water on them, and the boy removes the haulmy material to some intermediate place, in order that the same practice may be repeated. By persevering in this method for a little while, the whole of the slugs may be destroyed, as the least drop of the water speedily kills them. This practice, it is supposed, will be found highly beneficial in the flower-garden, as by watering the edgings of box, thrift, or other kinds, the slugs will be killed with certainty, even when the weather is moist.

The application is considered simple, the effect certain, and the expence trifling, whether in the garden or the field; a few pots only being required, in the latter case, to the acre, which can be made with a very small quantity of lime. And the labour is not of any material consequence, so that the whole charge will not, it is imagined, exceed five shillings the acre.

SLUICE, a frame of timber, stone, or other matter, serving to retain and raise the water of a river, &c. and, on occasion, to let it pass.

Such is the sluice of a mill, which stops and collects the water of a rivulet, &c. to let it fall, at length, in the greater plenty, upon the mill-wheel: such also are those used as vents or drains to discharge water off land. And such are the sluices of Flanders, &c. which serve to prevent the waters of the sea overflowing the lower lands, except when there is occasion to drown them.

Sometimes there is a kind of canal inclosed between two gates or sluices, in artificial navigations, to save the water, and render the passage of boats equally easy and safe, upwards and downwards: as in the sluices of Briare in France, which are a kind of massive walls built parallel to each other, at the distance of twenty or twenty-four feet, closed with strong gates at each end, between which is a kind of canal, or chamber, considerably longer than broad; in which a vessel being inclosed, the water is let out at the first gate, by which the vessel is raised fifteen or sixteen feet, and passed out of this canal into another much higher. By such means a boat is conveyed out of the Loire into the Seine, though the ground between them rise above one hundred and fifty feet higher than either of those rivers.

The sluice of a canal has generally a sliding-board or door, but sometimes folding or double doors moving on hinges, used to stop or let go water at pleasure.

Sluice-gates sometimes signify the lower gates of a lock, from the paddles or sluices that are usually fixed in them.

Sluices are made different ways, according to the use for which they are intended: when they serve for navigation, they are shut with two gates, presenting an angle towards the stream; when they are made near the sea, two pair of gates are made, the one to keep the water out, and the other in, as occasion requires. In this case, the gates towards the sea present an angle that way, and the others the contrary way; and the space inclosed by those gates is called the *chamber*. When sluices are made in the ditches of a fortress, to keep up the water in some parts, instead of gates, shutters are made so as to slide up and down in grooves; and when they are made to raise an inundation, they are then shut by means of square timbers let down in cullises, so as to lie close and firm.

The word sluice is formed of the French *escluse*, which Menage derives from the Latin *exclusa*, found in the Salic law in the same sense. But this is to be restrained to the sluices of mills, &c.; for as to those serving to raise vessels, they were wholly unknown to the ancients.

In *Rural Economy*, a sluice is very convenient in many cases. It ought to be strongly framed in deep waters, particularly where a great height is necessary, so as to stand

firm and immovable against the rushing of heavy bodies; for a small strain makes it leaky, and a small thing will occasion this, unless sufficiently guarded by proper abutments. Larch, green elm, or willow, are the best sorts of timber to be always in water; but heart of oak, for the purpose of standing above it, in wet and dry. The importance of sluices is extremely evident on many occasions, as when a pressing necessity demands the discharge of a great quantity of water, either the expensive mode of engines must be recurred to, the bank cut, or a sluice drawn. If the bank be cut, the passage is interrupted, and there remain the trouble and charge of removing the earth, and re-embanking; but a sluice vents the superfluous water, without the least inconvenience or charge. Their utility in many cases of drainage and embankment, as well as irrigation, is also very great and indispensable.

SLUIDENAIJA KORT, in *Geography*, a town of Russia, in the government of Irkutsk. N. lat. 52° 42'. E. long. 113° 44'.

SLUIN, a town and fortress of Croatia, on the Korrana; 34 miles S. of Carlstadt. N. lat. 45° 15'. E. long. 16° 8'.

SLUIS. See **SLUYS**.

SLUM, a town of Prussia, in Pomerelia; 8 miles S. of Marienburg.

SLUPCA, a town of the duchy of Warsaw; 15 miles S.S.E. of Gnesna.

SLUPE CZ, a town of Poland, in the palatinate of Sandomirz; 16 miles N. of Sandomirz.

SLUPICK, a town of Holland; 3 miles N.E. of Goude.

SLUR, in *Music*, a mark like the arc of a circle, drawn from one note to another, comprehending two or more notes in the same or different degrees. If the notes are in different degrees, it signifies that they are all to be sung to one syllable; for wind instruments, that they are to be made in one continued breath; and for stringed instruments, that are struck with a bow, as a violin, &c. that they are made with one stroke. If the notes are in the same degree, it signifies that it is all one note, to be made as long as the whole notes so connected; and this happens most frequently betwixt the last note of one line, and the first of the next; which is particularly called *syncopation*.

SLUSE, **RENÈ FRANCIS**, in *Biography*, an eminent mathematician, was born of a noble family at Vise, a small town in the bishopric of Liege, in 1622. He was educated for the church, and was canon of St. Lambert in that city, was appointed abbot of Amaz, and grand chancellor and counsellor to the bishop and prince; all which offices he retained with high reputation till his death in 1685, in the 63d year of his age. He was a man of great learning, not only in the particular line of his profession, but in jurisprudence, and even in medicine. He was eminently skilled in the Greek, Hebrew, Arabic, and other Oriental languages; and on that account was employed by the pope, during his residence at Rome, and after his return to Liege, in translating Greek, Armenian, and other writings. He was an excellent mathematician, and furnished some papers for the Transactions of the Royal Society, of which he was elected a member. As an author his principal work is entitled "Mefolabium et Problemata Solida," 4to. In this work M. Sluse rendered great service to the mathematical sciences, by simplifying some parts of the analysis of Des Cartes, which had engaged the attention of many eminent geometers. He is author of a method, by which any solid equation being proposed, it may be constructed in an infinite variety of ways, by means of the circle

circle and any one of the conic sections. He first gave a specimen of this method in the above work, but concealed the analysis till he published the second edition of it in 1688. An account of it is given by Montucla, in his "History of the Mathematics." This author remarks, that Sluse's Geometrical Miscellanies, which appeared in this second edition, do honour to the author, and afford a proof of the great progress he had made in analysis. Besides the work here referred to, he wrote two letters on the superiority of the Latin to the French language, which were translated from the Latin to the French, and published with the letters of M. Le Laboureur, in which a contrary opinion is maintained, under the title of "Avantages de la Langue Françoise sur la Langue Latin." Sluse's Papers in the Philosophical Transactions are, 1. "A short and easy Method of drawing Tangents to all Geometrical Curves," vol. vii. 2. "A Demonstration of the fame," vol. viii. 3. "On the Optic Angle of Alhazen."

SLUSS, or SLUDGE, in *Agriculture*, a word applied to mud or mire. It is sometimes written *slush*.

SLUTCH. See SLUCH.

SLUTER, MATTHEW, in *Biography*, a patrician of Hamburg, was born in that city in 1648. He studied jurisprudence at Jena and Altdorf, and made a tour through Germany and Holland. In 1673 he took the degree of doctor at Rostock. He practised the law in the chancery court of Güttrau, and afterwards visited France, and other places, from which he returned in 1679. He continued his professional labours in his native place, where, in 1701, he became syndic, and in two years afterwards a member of the council. He died in 1719, in the 72d year of his age. Besides various works on jurisprudence, he was author of one entitled "Sciagraphia Bibliothecæ Patrum maximæ," which was added to the "Propylæum Historiæ Christianæ" of his brother Severus Walter. Sluter was a curious observer of the weather, and wrote an illustration of a treatise on Meteorology, published at London in 1690, by William Cock of Edinburgh. In this tract the author endeavours to establish a connection between the changes of the weather and the heavenly bodies; and the object of Sluter in his illustration and commentary was to prove the truth of his theory from experience. The German edition of Cock's Meteorology was published at Hamburg in 1691. Our author likewise published tracts, entitled "Causes of the severe Winter and continual Storms in the Years 1694 and 1695;" and "Indications of the Aspects from the Years 1696 to 1703."

SLUYS, or L'ECLUSE, in *Geography*, a town of France, and principal place of a district, in the department of the Escaut. The place contains 1415, and the canton 4479 inhabitants, on a territory of 92½ kilometres, in 6 communes. This was formerly one of the best ports on the coast of Flanders, and capable of conveniently receiving 500 vessels; but it has been so much deteriorated, that it can now accommodate only small vessels. Its ancient name was "Lammens Vliet." It belonged to the comtes of Nevers, but was obtained in exchange for Bethune of William, comte of Namur, by Philip the Hardy, duke of Burgundy, who surrounded it with walls in 1385. In 1495 Philip de Cleves, lord of Ravenstein, revolted against Philip le Beau, and retired to Sluys, which was besieged by Albert, duke of Saxe, and after four months it surrendered. The city having taken part with the Hollander, was besieged by the prince of Parma in 1587, and the English garrison was compelled to surrender, but upon honourable terms. Until the year 1604 it remained in the possession of Spain; but being besieged by prince Maurice of Nassau, it

was obliged to surrender after a defence of four months. The town is furnished with sluices, by which the whole country may be inundated; and hence it derives its name. After several changes of masters, the garrison was summoned by the French republicans in July 1794; and on the 25th of August, after a gallant defence, became prisoners of war; 18 miles N.E. of Oltend. N. lat. 51° 20'. E. long. 8° 14'.

SLYBZE. See SLEBEZE.

SLYME-HEAD, a cape on the west coast of Ireland, in that part of the county of Galway, called Ballinablincl. N. lat. 53° 24', according to Beaufort, but 53° 29', according to Arrowsmith's late map. W. long. 10° 12'.

SLYPE, a town of France, in the department of the Lys; 5 miles N.N.W. of Menin.

SLYRET, a town of Norway, in the province of Aggerhuus; 80 miles N. of Christiania.

SMACK, is a small vessel only rigged as a sloop, or hoy, and used in the coasting or fishing trade; or as a tender in the king's service. See SLOOP.

SMÅLAND, or SMOLAND, in *Geography*, a province of Sweden, about 100 miles long and 60 broad, formerly governed by its own kings; and, for a considerable time, included in East Gothland, and subject to the same laws. It is said to have derived its name Smaland, *i. e.* small parcels of land, from the circumstance of its having been overspread with woods and wastes, which restricted the culture to a few intervening spots. Smaland is mountainous; nevertheless some parts are so improved by cultivation as to be very fertile, and its pastures in particular are excellent, and of course profitable to the graziers. This province comprehends large forests of beech and other trees; and also silver, copper, and iron mines, a great quantity of iron-ore being found at the bottom of the lakes. A vein of gold-ore has likewise been discovered in Smaland. The chief employment of the inhabitants is agriculture, mining, and grazing. The articles of trade are also planks, beams, masts, tar, pot-ash, iron, grain, cattle, butter, cheese, flesh, bacon, tallow, hops, and fish. In this province are 21 lakes, and its chief towns are Calmar, Wexio, and Jonkioping.

SMALBROKE, RICHARD, in *Biography*, an English prelate, was fellow of Magdalen college, Oxford; and in 1723 he was advanced to the bishopric of St. David's, from whence he was translated, in 1730, to Lichfield and Coventry. He died in 1749. He was distinguished by a vindication of the miracles of Christ against Woolston.

SMALCIUS, VALENTINE, a celebrated writer in favour of Unitarianism, was born in Thuringia, and died at Cracow, in Poland, in 1622. His principal work was "A Treatise on the Divinity of Christ," written in the Latin language, and printed in 1608.

SMALKALDEN, in *Geography*, a river of Germany, which runs into the Werra, 12 miles W. of Smalkalden.

SMALKALDEN, or *Schalkalden*, a large, thriving, and populous town of Germany, in the county of Henneberg, on a river of the same name. In its vicinity are salt-pits, and mines of iron and steel. The Protestant princes have had several meetings in this town, preparatory to the league which was concluded here in 1531, and to their confirmation of the theological articles drawn up by Luther, which have given this town considerable celebrity in ecclesiastical history; 27 miles N.N.E. of Schweinfurt. N. lat. 50° 47'. E. long. 10° 40'.

SMALL of an Anchor, is that part of the shank, next under the square, or anchor.

SMALL-Craft, in *Sea-Language*. See CRAFT.

SMALL Fruits, in *Gardening*, a term applied to those which

which are produced by different plants of a low shrubby growth, as those of the gooseberry, currant, and raspberry kinds, when grown alone, and in a separate state. See *STANDARD Fruit-Trees*.

SMALL Key, in *Geography*, a small island in the East Indian sea. N. lat. $10^{\circ} 37'$. W. long. $247^{\circ} 16'$.

SMALL Oat, in *Agriculture*, a name applied to a particular kind of black grain of this sort, in some places. It is hardy, and capable of being grown with success on poor land of the chalky and other kinds. Other names are also given to it; and there is a sort of oat termed the small short, or small shorts, in the farmer's language. See *OAT*.

SMALL Point, in *Geography*, a cape on the coast of Maine, forming the east point of Casco bay.

SMALL Repeat. See *REPEAT*.

SMALL Sallad Herbs, or *Sallading*, in *Gardening*, are such young tender herbs as are made use of through the year, for the purpose of furnishing sallads. For this use, several young seedling herbs of a warm nature are in request to mix with the larger principal sallad herbs, as lettuces, endive, and celery, in order to improve their flavours and wholesome qualities. The sorts mostly in use are cress, mustard, radish, rape, and turnep; also sometimes cabbage-lettuce for winter and early spring use; all of which, for this use, are in perfection when quite young, that is, while not more than a week, or ten or twelve days old, whilst they remain mostly in the seed-leaf, being then cut up close to the ground for use; for, being mostly of a warm relish, in which consists their chief excellence for winter and spring sallads, if suffered to grow large, and run into the rough leaf, they become of a disagreeable, strong, hot taste; but when used as above, they are exceedingly crisp and tender, with an agreeable warm flavour. For the purpose of sallading, these plants may be obtained young at all times of the year, in the spring and summer in the open ground, and in winter under the shelter of frames and glasses, and occasionally on hot-beds. This sort of sallading is procured by sowing the seeds of the different plants at different times, throughout the whole year.

Winter and Spring Culture.—In the winter and spring it may be raised either in hot-beds, or in the open borders, and, according as it may be required, early or late; but when it is required as early as possible, it must be sown in hot-beds, under frames and lights, &c. or in a bed or border of natural earth under glasses. The sowing should be made on hot-beds any time in December, January, or February; and where a considerable supply is daily required, it may be continued sowing every week or fortnight, in hot-beds, till March, or during the cold weather, for which a moderate hot-bed of dung should be made for one, two, or more garden-frames; but only half a yard or two feet depth of dung, according to the temperature of the season, as the heat is only required to bring up the plants quickly, and forward them a week or two in growth, placing a frame directly thereon, and moulding the bed all over with light rich earth, five or six inches thick, making the surface level and smooth: when, if it is to be forwarded as much as possible, directly sow the seed, which may be done either in drills as shallow as possible, about two or three inches broad, and flat at the bottom, and three inches asunder, sowing the seeds of each sort separately, and very thick, so as almost to cover the ground, only just covering them with earth; or, to make the most of the bed, it may be sown all over the surface, previously smoothing it lightly with the back of the spade, the different sorts separately, and all very thick; and after pressing them all even and

lightly down with the spade, covering them very thinly with earth, by sifting over as much light mould as will only just cover the seed; and as soon as the sowing is performed in either method, putting on the lights. The seeds soon come up, as in two or three days, or less, being careful at this time to give vent to the steam arising in the bed, as well as to indulge the plants with plenty of free air daily, either by tilting the lights in the back or front, according to the temperature of the weather, or by drawing the lights a little down, or taking them quite off occasionally in mild days at first; for the hot-bed being yet new, there will be a considerable steam arising; and the sallading coming up very thick, unless due vent be given to pass off the steam, and admit fresh air, the plants will be apt either to burn or fog, (as the gardeners term it,) and mould off as fast as they come up. Such hot-beds, however, as are not fresh made, do not require this precaution; but in new-made beds it must be strictly observed, till the sallading is all fairly come up, and as long as the strong steam continues. The plants will mostly be fit for use in a week, or ten or twelve days, from the time of sowing the seed.

But in order to have a proper succession, the sowing in the hot-beds should be repeated every week or fortnight during the cold weather; the same hot-bed sometimes retaining its heat, will admit of two sowings, by sowing again as soon as the first crop is gathered: however, to obtain a regular supply daily, it is necessary to continue making fresh hot-beds occasionally. Where only a small quantity may be wanted at a time, and there is the convenience either of cucumber and melon hot-beds, or a hot-house, &c. some seed of each sort may be sown in pots or boxes, and placed in these hot-beds, or the stove, just to bring up the plants fit for use. And where there are not frames and glasses, hand or bell-glasses may be used, or the bed be arched over with low hoop-arches, in order to cover it with mats every night, and in bad weather.

Where, however, there are no hot-beds, in cold weather, early in the spring, part of a warm border, or a bed of light earth in a sunny situation, may be prepared for garden-frames and lights, hand-glasses, &c. raising the ground somewhat to the sun; and having dug it, and raked it fine, sow the seed as above, covering it lightly with earth; and having set on the frames and glasses, the seeds will soon come up, and the sallading be ready a considerable time sooner than in the open ground.

Culture in the full Ground.—From about the end of February, or beginning of March, according to the forwardness or mildness of the season, small sallading may be sown in the open ground, repeating the sowings every week or ten days; the first sowing being performed on a warm border; continuing the sowings in that situation till the beginning or middle of April, when it may be sown in any of the open quarters, and in which the sowings may be repeated weekly, or once a fortnight, as required; but according as the hot weather approaches, sowing in a somewhat shady situation. The ground for each sowing in the different situations should be properly dug, and the surface raked smooth and even.

These sowings are mostly made in shallow drills, which should be drawn with a small hoe, either with the corner, or held edgewise downward, horizontally, drawing the drills along evenly, as shallow as possible, and flat or level at bottom, at three or four inches asunder, in which the seeds should be put evenly all along the bottom, each sort separately, and very thick, covering them in evenly with the finest of the mould, not more than a quarter of an inch deep; or if the smaller seeds are but just covered, it is sufficient;

for when sown very thick, if deeply covered with mould, the plants do not rise regularly. In these early spring sowings, on cold nights, and in all bad weather, it is proper to cover the ground, both before and after the plants begin to rise, with large mats; which will be better, if supported on low hoop-arches, or ranges of pegs stuck in the ground just high enough to support the mats a little from the earth, by which a more effectual as well as forward crop is produced.

But in the latter sowings, when dry warm weather commences, it is proper to give occasional waterings. It is likewise sometimes necessary, where the surface of the ground becomes crusted from wet, &c. as the plants rise thick, to slightly brush over the surface with the hand or a soft broom, so as to reduce the surface mould a little, and promote their coming up.

Summer Sowings.—When the sowings are practised in summer, they should be made more frequently, and the ground be kept watered occasionally, both before and after the plants are come up.

Autumn Sowings.—The sowings may be continued in the open ground all September and October, also occasionally in November, in mild seasons; and until towards the middle of October, they may be made in any open situations; but from the middle or latter end of October, and in November, they must be on warm south borders, performing the sowings as above; and in cold nights, bestowing a covering of mats or hand-glasses, &c. repeating the sowings every week or ten days, or a fortnight, as required.

In gathering young fallading, it should be cut carefully close to the ground, while quite young; in performing which, a large pair of scissors is very convenient.

In order to have good seed, some plants should be preserved annually for the purpose.

SMALL Stones, among *Jewellers*, denote diamonds under the weight of a carat.

SMALL-Work, is used to denote the star and shell-facets of diamonds.

SMALLAGE, in *Botany*, a species of *apium*; which fee.

Smallage grows naturally by the sides of ditches, in many parts of England, and is therefore rarely cultivated in gardens: it is biennial, and flowers in August. Care should be taken to distinguish smallage from the poisonous water-hemlock, which grows naturally in the same places with it; the latter has its leaves deeply divided, quite to the pedicle, into three long narrow sharp-pointed segments; whereas those of smallage are only slightly cut into three roundish obtuse ones.

The root is that part which was formerly used in medicine: it is about the thickness of a thumb, whitish, fibrous, of a warm taste, and a fragrant smell; and was reckoned one of the five greater openers of the shops. It was reputed to be grateful and detergent, to promote urine, and to dislodge gravel; and it was also recommended in disorders of the breast, and for promoting expectoration.

The fresh roots, especially when produced in their native watery places, are supposed to participate, in some degree, of the ill quality of those of the hemlock kind, and to be particularly hurtful to epileptic persons and pregnant women.

Its seed was also of the number of the lesser hot seeds, and was thought to possess greater virtues as a carminative and aperient than the root; its leaves having been given in decoction, or the expressed juice of them in nephritic complaints. The root was greatly recommended against suppressions of the menses, and of the lochia, and was even

said to be alone a remedy for the king's evil; but this wants proof.

Smallage is now wholly exploded from the *materia medica*.

SMALL-POX, in *Medicine*, the *Variola* of authors, a highly contagious and formidable eruptive fever, which occurs in general but once during the life of any individual, and is distinguished by the appearance of pustules on the skin, on the third or fourth day of the fever.

As we have already entered into a brief detail of the little that is known respecting the origin and early propagation of small-pox, (see *INOCULATION*;) it may be sufficient to mention in this place, that it is generally believed that this contagious malady existed in China and Hindoostan, perhaps for some centuries previous to its appearance in Europe; but that there are no very authentic records of its travelling to the west, until the period of the siege of Mecca by the Abyssinians, in the year 572, when it destroyed the invading army. Alexandria being at that time the great mart of Indian commerce, was soon infected with the contagion, and the first description of the disease was given by Ahron, a physician of that city, in the beginning of the following century. From that time it accompanied the Arabs or Saracens in their progressive expeditions, and Europe was contaminated by their invasions of Spain, Sicily, Italy, and France in the eighth century. Previous to this period, it is generally believed that this destructive pestilence was unknown in Europe. This is principally inferred from the silence of all the ancient physicians, Greeks and Romans, who have left us accurate descriptions of many of the diseases, with which we are now familiar, but who have not described the striking and peculiar symptoms which characterize this severe and often fatal malady. Some authors, however, and not without a show of probability, have maintained that such an inference is not strictly deducible from this circumstance. For the ancients were apt to confound every species of fatal fever under the term *pestilence*, and were misled, by their hypothetical doctrines about the four humours, to make no distinctions from a view of the symptoms. Some of the ancient plagues, and particularly that of Athens, described by Thucydides, were manifestly not *the plague* properly so called, but were connected with extensive sores and eruptions on the skin. (See *PLAGUE*.) It has been urged, too, that in a fragment of the works of one Herodotus of Rome, preserved by Aëtius, there is a description of various fevers, accompanied by eruptions, in which the small-pox appears to be distinctly included. It is remarkable, too, that the first Arabian physicians, even Ahron of Alexandria, do not mention the disease as a new malady, but speak of it as one familiarly known; and Rhazes refers to Galen, as having mentioned many of its symptoms. The evidence in support of this opinion is certainly very imperfect, and scarcely sufficient to build a controversy upon; nor is it of any farther importance than as an object of curious inquiry.

All that relates to the history and practice of *inoculation* (which, indeed, should now be superseded by vaccination) has been also detailed in the article already referred to. At present, therefore, our object is to give only the medical history of small-pox, as it occurs in the casual, or, as it is often called, the natural way; describing, first, its symptoms, with the prognostics, and various tendencies of the disease, and afterwards the best methods of treatment.

The term *variola*, which is of modern origin, is supposed to be derived from *vari*, which are small inflamed tumours of the face, occurring about the period of puberty, and noticed first by Celsus under that appellation. The words *pock*, *pocks*, and *pox*, from the Anglo-Saxon *pocca*, signifying a pouch

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pouch or pocket, and applicable to any pustule or pustular disease, were appropriated early to this formidable malady; and the epithet *small* was subsequently added to distinguish it from a still more recent disease, the *lues venerea*, to which the same appellation was applied.

Several varieties of the small-pox have been noticed by different writers, but they may be all included under the two principal forms, which were so ably pointed out by Sydenham, and which since his time have been commonly recognized under the appellations of the *distinct* and the *confluent* small-pox. Although originating from the same contagion, and not differing from each other essentially, they exhibit a different series of symptoms, pursue a somewhat different course, and require a different mode of treatment, and therefore it is convenient to treat of them separately.

1. *Of the Distinct Small-Pox:—Variolæ Discretæ.*—In this form of the disease, the eruptive fever is moderate, and not easily distinguished from an ordinary attack of common inflammatory fever. It generally begins about mid-day, with a chilliness and shivering, accompanied by a considerable languor and drowsiness, which are soon followed by a great heat, pains in the head and back, sickness at the stomach, with a foreness or pressure in that part, and in adults, especially if they are kept in bed, with a great disposition to perspiration. In children the sweating does not occur; but they are liable to frequent startings from their slumbers, and on the third day are sometimes affected with one or two fits of convulsion. Sydenham considered this symptom as rather favourable; having observed that it was commonly succeeded by an eruption of a large and mild small-pox. On the evening of the third, or the morning of the fourth day, the eruption appears, and gradually increases during the fourth and fifth days, arising first on the face, and successively on the inferior parts, so as to be completed over the whole body on the last-mentioned day. With the appearance of the eruption, the febrile symptoms abate, and nearly or altogether cease on the following day, with the completion of the eruption. This appears first in small red spots, scarcely eminent, but which, by degrees, rise into minute pimples, which are separate and distinct from each other, and generally not very numerous. The day after their appearance, a small vesicle, containing a clear or slightly whey-coloured fluid, shews itself on each of the spots. For two days these vesicles increase in breadth only, and there is a small depression in their centre. As they extend, they continue to be surrounded with an exactly circular inflamed margin, which, when the pustules are numerous, covers the greater part of the intervening skin, and diffuses somewhat of a damask hue over the spaces between the pustules. Under the touch they are hard, and rather painful, and give the impression of small round seeds under the cuticle to the finger; a circumstance which tends to distinguish them from the vesicles of chicken-pox, which feel like small seeds flattened by pressure.

About the *eighth* day, the eruption is elevated into spheroidal pustules; and if these are numerous, the increase of their size and the fullness of the surrounding parts occasion a considerable swelling of the whole face, and especially of the eyelids, which are so distended as entirely to close the eyes, and often shine like an inflated bladder. Sometimes, where numerous pustules fix upon the eye-lids, the blindness comes on before the eighth day. The eruption now assumes a whiter appearance; for, as the disease proceeds, the matter in the pustules becomes by degrees more opaque, and at length, as the suppuration increases, of a yellowish colour. A similar progress is observed in the hands, but a little later; so that when the face is becoming rough and yellow, the extremities are becoming smoother and whiter. On the *eleventh* day the swelling of

the face is much abated, and the inflammation diminished; the pustules are now at their height, and seem quite full. On the top of each a darker spot appears; and at this place the pustule, on the eleventh day or soon after, is spontaneously broken, and a portion of the matter oozes out; in consequence of which the pustule is shrivelled and subsides, while the matter oozing out dries, and forms a crust upon its surface. Sometimes very little of the matter oozes out, but remains in the pustule, becoming thick, and even forming a hard little scab. After some days, generally about the fourteenth or fifteenth, both the crusts and the hardened pustules fall off, leaving the skin on the points which they covered of a brown red colour; and it is only after many days that these red marks are effaced. The distinct small-pox seldom leaves any pits in the skin; but in some cases, where the matter of the pustules has been more liquid, the crusts formed by it are later in falling off, and the points which they covered undergo some degree of ulceration, which partially destroys the substance of the skin, and produces a small excavation or pit. Sydenham and Cullen ascribe this erroneously to the desquamation which ensues.

As the eruption is successive, so the maturation on the body and extremities follows the same course as above described, but a little later. On the tenth and eleventh days, as the swelling of the face subsides, a swelling arises in the hands and feet, which again subsides, as the pustules come to maturity. In the pustules of the hands and arms, indeed, the matter is frequently absorbed; so that at the height of the disease, these pustules appear as empty vesicles.

When the pustules on the face are numerous, some degree of feverishness appears on the tenth and eleventh days, but it ceases again after the pustules are fully matured, or continues only in a very slight degree till the last pustules on the feet have finished their course. In the distinct small-pox this secondary fever is never considerable, and seldom continues longer than the period just mentioned. Under the same circumstances, an abundant crop of pustules on the face, some uneasiness in the throat, and a hoarseness of voice, occur about the sixth or seventh day, and a thin fluid is poured out from the mouth. These symptoms increase with the swelling of the face; and the discharges from the mouth and throat becoming thicker and more viscid, are more difficultly ejected. Some difficulty of swallowing also occurs; so that liquids taken in to be swallowed are frequently rejected, or thrown out by the nose. But all these affections of the fauces abate as the swelling of the face subsides.

Some varieties of the distinct small-pox have been described by different authors under specific appellations, such as the *contiguous*, the *coherent*, the *warty*, &c. small-pox (see Walker's Inquiry into the Small-pox, chap. viii. and Roe's Treatise on the Natural Small-pox, chap. i.); but these are merely more violent degrees of the disease, partaking more or less of the character of the confluent species, and requiring to be treated accordingly.

2. *Of the Confluent Small-pox.*—This form of the small-pox follows a similar course with the preceding species, but the symptoms of every stage are more violent, and several of the circumstances are also different. The eruptive fever especially is much more violent; the pulse is more frequent, sharp, and contracted; the head-ache, and the pain and anxiety at the præcordia, the sickness and vomiting, are more severe; the coma is more considerable, and there is frequently a delirium. In adults there is less disposition to perspiration than in the other species, and sometimes a diarrhœa occurs; and in children epileptic fits are frequent on the first days of the disease, and sometimes prove fatal before any eruption appears.

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appears, or they usher in a very confluent and malignant small-pox.

The eruption appears more early than in the benign small-pox; commonly early on the third day, or on the evening of the second, and scarcely ever so late as the fourth day; except, as Sydenham remarks, in a few rare cases, where it appears to be delayed by some violent symptom, such as an acute pleuritic or rheumatic pain, or a violent pain in the stomach, with sickness and vomiting, which manifestly indicate the confluent and dangerous nature of the forthcoming disease. The eruption too is often preceded by an extensive erythematous efflorescence, like a commencing erysipelas; and sometimes it comes out in little irregular clusters, like the measles, consisting of many crowded red points or pimples. The pimples are always most numerous on the face, and at the same time smaller and less eminent. The little vesicles which form on the tops of the pimples, appear sooner than in the distinct species, and while their diameters extend, they do not retain a circular form, but are of very irregular figures. Many of them run into one another, forming a flat irregular surface, so that the face very often appears to be covered rather with one extended vesicle, than with a number of pustules. And when there is any distinct separation of the pustules, they do not rise to a spheroidal form, but remain flat, and their circumference is not bounded by an inflamed margin, the part of the skin that is free from pustules being commonly pale and flaccid, and not exhibiting the damask hue of the distinct small-pox. The fluid included within the pustules changes about the eighth day from a clear to an opaque appearance, being first whitish and now brownish, but never acquires the yellow colour and thick consistence that appear in the mild species.

In the confluent small-pox, the swelling of the face, which is sometimes absent from the distinct species, but is generally present when the pustules are numerous, never fails to appear, and it comes on more early, and arises to a greater degree, sometimes annihilating every appearance of the features. It abates, however, on the tenth day, and on the eleventh still more. At this time the pustules or vesicles, or rather the extended pellicle, which from the eighth day had become rough and brown, is ruptured; and, shrivelling, pours out a fluid, which concretes into brown or black crusts, which do not fall off for many days, even till after the twentieth day; and, in consequence of the ulceration which takes place under them, pretty certainly leave the surface of the face considerably pitted. On the other parts of the body, and on the extremities, especially the hands and feet, still more than on the trunk, the pustules of confluent small-pox are larger and more distinct than upon the face; but they never acquire the same maturity and consistence of pus as in the properly distinct kind.

The confluent small-pox is attended by two other symptoms of considerable importance, the one in adults, the other in children. The former is salivation, or excessive secretion of saliva, which never fails to accompany the confluent form of the disease in grown persons, and is sometimes seen in a slight degree in the distinct kind. It sometimes begins as soon as the eruptions appear; and sometimes not till a day or two after. The saliva is for some time thin and copious, and easily discharged, having very much the appearance of the ptyalism excited by mercury, except that it does not smell so offensively; but about the eleventh day it becomes thick and more viscid, and is expectorated with great difficulty. The patient is very thirsty, and coughs while he attempts to drink, expelling the liquor through his nostrils. The affection of the throat is also generally aggravated at the same time. The salivation often ceases after the eleventh

day, about which time the hands commonly swell (or at least, Sydenham says, ought to do so); but sometimes, after a complete cessation for a day or two, it returns again.

In children, a diarrhoea occurs frequently in the place of the salivation; but it does not seize them so early as the salivation attacks grown persons. Whenever it begins, however, unless it be checked by art, it attends the disease to its termination.

In the distinct small-pox, as we have already stated, the fever commonly ceases with the completion of the eruption on the fifth day; but it is not so in the confluent species. In the latter, the febrile symptoms only suffer a remission at the time of the eruption, which continues to the period of complete maturation, that is, to the eleventh day, in the latter part of which day it is often renewed with considerable violence, constituting what has been called the *secondary fever*, which is the source of much danger, and is of various duration. The pulse quickens, the heat of the body increases greatly, much thirst, with great anxiety and restlessness, severe head-ache, short and confused slumbers, delirium, and sometimes coma, ensue. These symptoms, indeed, are often so sudden and violent, being accompanied also with suppression of the salivation, and a difficulty of breathing and of deglutition, that, if nothing has been done to alleviate the early inflammatory action, death soon follows. Whence Sydenham speaks so often about the danger of the eleventh day. In other cases, however, this fever is protracted to the fourteenth and seventeenth days, and sometimes even later, and yet terminates fatally. In some instances, these severe forms of confluent small-pox are accompanied by symptoms of great malignancy or putrescency, as it has been called: purple spots, or *petechiæ*, appear in the interstices of the skin between the pustules; and sometimes small black spots, scarcely so large as pins' heads, arise on the top of the eruptions in different places; or a disposition to gangrene under ferous vesicles shews itself; or lastly, various spontaneous hæmorrhages take place from the internal parts, as from the kidneys and bladder, whence bloody urine is discharged; or from the lungs, in bloody expectoration; and sometimes from the intestines, in bloody stools.

From a consideration of the preceding detail of the various circumstances which accompany the different forms and stages of the small-pox, the degree of danger under the various symptoms, and the probable event in particular cases, may be estimated. The following points of prognosis will be obviously inferred. In general, the more exactly the disease retains the form of the distinct kind, it is the safer; and the more it approaches or takes the form of the confluent kind, it is the more dangerous. It is only, indeed, when the distinct kind exhibits a great number of pustules in the face, which are contiguous or coherent, that it is attended with any danger: for it must be observed, that it is chiefly from the crowd of pustules on the face, and not from those on the body, that the danger of the disease is to be apprehended. Particular symptoms will enable us to anticipate particular occurrences. Thus, if the previous or eruptive fever be very violent in its attack, and be accompanied with great prostration of strength, anxiety, and lowness of spirits, with severe head-ache, weeping and redness of the eyes, great pains in the back, a burning heat of skin, and a quick hard pulse;—the occurrence of a confluent eruption may be expected. The more early the eruption, the more danger is to be anticipated; but a retardation of the eruption beyond the fourth day, also implies a probability of a confluent disease. The more gradual the eruption of the pustules, the more favourable; provided

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vided the time of their rising be not protracted beyond the usual limits by diarrhœa, pain, or depressing passions. The more distinctly suppuration takes place about the eighth day, and the more rosy the interstices around the pustules, the less danger is to be apprehended. A sudden cessation of the swelling of the face about the eleventh day, and the non-appearance of that swelling about the eighth day, when the pustules are very numerous, are indicative of great danger; as are also a sudden suppression of the salivation in adults, and of the diarrhœa in children, at the former period; especially if the hands and feet have not exhibited any swelling about that time. If, in the distinct small-pox, convulsions occur in children after the eruption is come out, or after incrustation has taken place, death commonly ensues; or, if the patient survives, a paralysis of some of the limbs often remains. The discharge of pale and clear urine, with frequent urging to pass it, in any period of the disease, denotes great danger.

On the other hand, regular gentle sweats, and a free discharge of urine, which deposits a sediment, are favourable symptoms in every species of small-pox. If, in the turn of the confluent small-pox, the pustules, which were before pale and flat, should acquire a redness or damask-rose colour round their bases, and suppuration come on, the patient generally recovers.

When the small-pox attacks women in a state of pregnancy, it is attended with considerable danger, and commonly produces miscarriage or premature labour. It has been a question among pathologists, whether the connection between the child in the womb and the mother was such as to admit of the infection of the former with the small-pox under these circumstances. Whatever hypothetical differences might exist upon this topic, experience has proved that such infection often takes place in the fœtus *in utero*, though not invariably. It would appear, too, that the child is not affected at the same moment with the mother, but soon afterwards by subsequent infection. For, in a case related by Dr. Laird, a woman in the fifth month of her pregnancy passed through a severe small-pox, which commenced about the end of August: she felt the motion of the child till the month of October, on the 28th of which month she was delivered of a child, which was thought to be of six months' growth, and which had been dead some days. "On the back, shoulders, and side, and particularly about the upper part of the thighs, where the integuments were perfectly sound, there were several pustular elevations, with central depressions, strikingly characteristic of the appearances which distinguish small-pox. The fœtus was placed in the museum of Guy's Hospital, and still distinctly exhibits the characters of the eruption." See *Edinburgh Med. and Surg. Journal*, for April, 1807.

A still more extraordinary circumstance, in respect to the infection of the child in the womb, occasionally occurs; namely, the production of small-pox in the child, in consequence of the mother's exposure to the contagion, although the latter may have been prevented from suffering the disease herself, by having previously undergone that disease, or the cow-pox, and therefore escapes the influence of the infection. Dr. Jenner relates the following case, which came under his observation, in the instance of a lady in London. "A few days previous to her confinement, she met a very disgusting object, whose face was covered with the small-pox. The smell and appearance of the poor creature affected her much at the time; and though she mentioned the circumstance on her return home, she had no idea that her infant could suffer from it, having had the small-pox herself when a child. During a few days after its birth the

little one seemed quite well; but on the fifth day it became indisposed, and on the seventh the small-pox appeared. The pustules, which were few in number, matured completely. Dr. Croft, who attended her, being curious to know the effect of inoculation from one of the pustules, put some of the matter into the hands of a gentleman eminently versed in that practice, which produced the disease correctly. Mrs. W. was not sensible of any indisposition herself from this exposure, nor had she any appearance of the small-pox." Another case is mentioned by Dr. Jenner, in which the child *in utero* was infected with small-pox contagion, and born with the eruption upon it, five weeks after the mother had been vaccinated, and a month after she had been exposed to the contagion of small-pox from three of her children. Whence, as Dr. Jenner justly infers, it is obvious, "that the small-pox virus may affect the human frame, even to its inmost recesses, although apparently freed from its effects, and yet give no evidence of its presence by exciting any perceptible disorder." (See *Medico-Chirurgical Transactions*, vol. i. p. 272. Also, Van Swieten, *Comment. ad Aphor.* 1381; and Dr. Mead's *Discourse on Small-pox*, chap. iv.) Dr. Mead states the following analogous fact. "A certain woman, who had formerly had the small-pox, and was now near her reckoning, attended her husband in the distemper. She went her full time, and was delivered of a dead child. It may be needless to observe, that she did not catch it on this occasion; but the dead body of the infant was a horrid sight, being all over covered with the pustules; a manifest sign that it died of the disease before it came into the world."

Though the confluent small-pox should not be immediately fatal, yet the more violent kinds are often followed by a morbid state of the body, under which various disagreeable and dangerous complaints arise. Whether these consequences may be ascribed, with Dr. Cullen, sometimes to an acrid matter, generated by the preceding disease, and deposited in different parts, and sometimes to an inflammatory diathesis produced, and determined to particular organs of the body, is a theoretical inquiry, which we are not disposed to puzzle ourselves and our readers by pursuing. It is manifest, in general, that the constitution is often left in a state of great debility; does not thrive under the ordinary nutrition; and in many cases exhibits a great tendency to scrofulous inflammation, especially of the glandular system, to chronic derangements of the lungs, mesentery, and other viscera, and to various local affections of the skin, membranes, and bones. Another series of evils, which the confluent small-pox is liable to inflict, is the various degrees of injury and destruction which it occasions in the organs of sense, especially in the eyes and ears. Deafness of one or both ears, and the loss of sight in one or both eyes, is no uncommon result of this formidable malady. It appears indeed, from the records of the humane "Institution for the indigent Blind," that a very large proportion of all that claim its protection have been blinded by the small-pox.

Causes of Small-pox, and of its Varieties.—The only exciting cause of small-pox is the specific contagion, generated in the pustules of the disease itself. In what manner, or at what period of time, this great depopulator of the human race was generated, or what physical circumstances concurred to give it existence, history affords us no means of ascertaining. The absurd speculations of the Arabian physicians, respecting the origin of the disease from some contamination of the fœtus with the menstrual impurities of the mother, deserve no notice. The obvious origin of a disease, (so analogous to small-pox, as to supersede the influence of its contagion on man,) from a disease of the skin

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of the heels of a horse, of which the cow-pox has recently afforded an example, has led some speculators to the more probable conjecture, that the poison of small-pox may have been communicated to the human from some domesticated animal. The camel has been suggested: but it was forgotten, that, though Arabia was the country from which Europe probably received the contagion; yet that that country appears to have received it from the most eastern nations, by its early commerce, among whom it had previously existed from remote antiquity. (See Moore's interesting "History of the Small-pox," 1815.) At present we can only attend to the operation of this contagion, and investigate its qualities from the effects which it produces.

It is evident, that the contagion of small-pox is capable of being communicated, and of exciting the disease in others, both by the actual contact of the fluid of the pustules, and the dried crusts, and by diffusion in a state of solution in the atmospheric air. It may be also fixed and adherent to various substances, such as woollen, linen, cotton, and other materials of clothing, as well as to wood, and other articles of furniture; from which also it may exhale in a state of vapour. Whence a person may be infected, without actual contact either of the diseased, or of *fomites*, that is, of infected substances. We have already stated, however, at great length, under the article **CONTAGION**, (which see,) the proofs and experiments by which it is rendered manifest, that the influence of this, and probably of most other contagions, by diffusion in the atmosphere, is limited to a very small distance from the source of infection. We refer especially to the experiments of Dr. O'Ryan, of Montpellier, upon that subject, which are related in the article just referred to. See also Dr. Haygarth's Plan for the Extermination of Small-pox in Great Britain.

One property of the contagion of small-pox, which it possesses in common with the contagion of measles, scarlet fever, and chicken-pox, but which does not belong to the contagion of gaol-fever, or typhus, nor to that of the plague, nor to the chronic contagious maladies, syphilis, and scabies, is its power of affecting the constitution *but once during the life of the individual*. The occurrence of the disease, under the mildest or the most severe form, equally renders the body incapable of receiving the disease again. This is the general fact; but in regard to none of these eruptive fevers can it be affirmed, without many exceptions: and the small-pox presents many anomalies in this respect. The extreme rarity of a second attack of small-pox was noticed by the Arabian writers; and their admission of such a fact would scarcely be admitted as a proof of its occurrence, since they deemed the small-pox and measles to be but varieties of the same disease. They attempted to explain the occasional recurrence of the disease upon their absurd theory of its origin, supposing that the whole of the menstrual blood, which contaminates the child, is not thoroughly depurated and expelled by the first attack. Even Boerhaave seems to have believed, that the *distinct* small-pox did not invariably secure the individual from a subsequent attack of the *confluent* form; though the latter effectually prevented a recurrence. (See his *Praxis Medica*, § 1381.) This, however, is not consistent with fact: for some of the most formidable and even fatal attacks of *second* small-pox have occurred in persons previously much pitted and disfigured by the disease. It will not be necessary to enter, in this place, into a very minute detail of the cases of secondary small-pox: it will be sufficient to state the fact, and to refer to some of the authorities on the subject of recent date, since the distinctions between chicken-pox, and the

modifications of small-pox, have been fully established. The celebrated Dr. De Haen has related several very clear instances of second small-pox, which occurred in his own practice. One young man, a student of law, received the contagion twice within three years; the first attack left him pitted, and the second proved fatal. (See his *Ratio Medendi*, p. ix. ch. 7: also his *Epist. Apolog. Responf. ad B. L. Tralles*.) One of the most striking cases of this sort, is that of Mr. Langford, whose countenance was "remarkably pitted and leamed" by a former malignant small-pox, "so as to attract the notice of all who saw him:" yet at the age of fifty, he was attacked again with confluent small-pox, which proved fatal to him, and to another member of his family, five of whom received the infection from him. (See *Memoirs of the Medical Society of London*, vol. iv.) A case of distinct recurrence of small-pox is related by Dr. Laird, in the *Edinburgh Journal*, already referred to; another by Dr. Bateman, in the *Medico-Chirurgical Transactions*, vol. ii. p. 31; and Mr. Ring has collected a great number, to the amount of sixty or seventy, in his *Treatise on Cow-pox*, and in various numbers of the *London Medical and Physical Journal*, especially in volumes 12, 14, and 15. We may add, that the recurrence of measles, in several cases, has been lately authenticated, by the first medical authority now living, (we mean by Dr. Baillie, in a paper published in the third volume of the *Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge*. The scarlet fever appears to be also subject to the same anomalies occasionally. The exceptions, however, are rare in all these eruptive fevers, and the general rule will still hold good. Yet the considerations of these exceptions should remove our surprise, that the cow-pox should not invariably secure the constitution from a subsequent seizure by the small-pox; since its influence on the system is commonly less considerable, than that of the mildest distinct small-pox. We believe, however, that the small-pox, which, under the exceptions, has been occasionally seen to follow the cow-pox, has *always* been much mitigated by the prior operation of the vaccine *virus*, both in the violence and duration of the symptoms, and that it has never, in these cases, terminated fatally.

It appears, from the preceding history of the symptoms, that the safety and danger of the small-pox depends almost entirely upon the smaller or larger number of the pustules: it becomes very important, therefore, both with a view to the prevention and to the treatment of the disease, to investigate the origin of this difference in the eruption, and in the symptoms which accompany it.

From the difference in the appearance, consistence, colour, &c. of the matter produced, as well as in the number and form of the pustules, and from the various degrees of fever, and other symptoms, which accompany the different species of small-pox, it might be readily suspected, that the contagion itself was different. Experience, however, has completely refuted this supposition: for there are innumerable instances of the contagion, arising from a person affected with the mild and distinct small-pox, producing the confluent kind in others; and, on the other hand, it is extremely common to see the distinct kind produced by exposure to the contagion arising from a person affected with the worst confluent small-pox. The practice of inoculation has still farther demonstrated this fact. For the same matter was not unfrequently observed to produce in one person the distinct, and in another the confluent small-pox. And in order that no time should be unnecessarily lost, where persons have been in the most imminent danger from complete

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complete exposure to the contagion, inoculation has been immediately performed from a confluent subject; yet the subsequent disease has been distinct and mild. We remember to have heard Dr. Gregory, the able professor of the practice of physic at Edinburgh, assert, in his lectures, that he had once taken matter from the confluent small-pox of a dying child, with which he inoculated two of its brothers: they had both a very mild disease: one of them, however, had previously taken the casual infection, for he sickened in three days from the time of inoculation. Indeed we could state other facts, from the same authority, to prove that matter, taken from the pustules of the dead body, has produced even the mildest form of small-pox. It is manifest, therefore, notwithstanding the prejudices of mankind, that the nature of the original contagion has no influence in modifying the disease which it inflicts: and we must infer, that the various forms which the disease assumes, originate from some particular state of the constitution in the individuals whom it thus variously handles. And this condition of the constitution must be the result of external causes, such as the seasons, and state of the atmosphere; or of internal and personal causes, such as plethora, obesity, irritability, or the contrary, depending on original conformation, or upon indulgence, intemperance, affections of the mind, and so forth. It is not the contagion of small-pox alone, which is variously modified in this way by the existing condition of the constitution; almost all external agents are so modified. The scratch of a thorn will not be felt for an hour by one person; while in another it will inflame and form an abscess, even excite the absorptents, and produce a bubo and fever; or it may run on to gangrene, and occasion death. In like manner, if several people are exposed to cold, by falling into water, for instance, and remaining wet: the effects will be very different individually. Many will escape without inconvenience; some with a common coryza or sore-throat; another will be confined to bed for weeks with an universal rheumatism; another will be attacked with pleurisy, or a spitting of blood, or an inflammation in the bowels. It is precisely the same with the varieties of small-pox: they are not the result of a difference in the cause, but solely of a difference in the state of individual constitutions.

The effect of different seasons upon the human constitution does not admit of very satisfactory explanation. Sydenham and Boerhaave, both able observers of nature, remarked, that the regular and distinct small-pox usually appears about the vernal equinox, when it is epidemic, increasing through the summer, and attaining its height and severity in the autumn, and commonly disappearing with the approach of the winter's cold. They both also observed, that if it commences early, as in January or February, (and Boerhaave adds, more particularly if it has been absent from the place six years,) the following summer will be distinguished by an epidemic of a severe and fatal kind, sparing none who have not previously undergone the disease, and proving extensively destructive.

The internal peculiarities of constitution, which modify the operation of morbid causes in general, and of the contagion of small-pox in particular, are more obvious and intelligible. Various hypotheses about the fermentation excited in the blood, and the free exit or deposition in the skin of the contagious matter, thus multiplied by that process, have been formed to explain this point: and even Dr. Cullen has adopted this absurd humoral notion, and endeavours to point out the circumstances "which determine more or less of the variolous matter to *stick in the skin*, or to pass freely through it." (First Lines, § 598.) But
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these notions are inconsistent with facts. In the first place, there is no evidence that the contagion acts like leaven upon the blood, "and assimilates a great part of it to its own nature." (Cullen, loc. cit.) The blood, as far as its properties are cognizable by the senses, possesses no qualities which are not common to all inflammatory diseases. There does not appear, indeed, to be any thing analogous to fermentation in the process. The pus that is generated is the result of the inflammatory action of the vessels of the skin, and is generated in the skin only; it is not floating in the mass of circulating fluids, and detained in the skin, as by a sieve. Whatever, therefore, increases the inflammatory action, increases the number of pustules. Thus, parts of the body that are much heated, as by lying upon them, or keeping them in long and close contact, have a greater number of pustules than others; and parts that are covered with plasters, especially those of a stimulant kind, are always more thickly beset with pustules. If we extend this principle to the constitution generally, we shall find, that those persons who are by nature, their period of life, their mode of living, previous indisposition, the season of the year, or other causes of a more irritable and inflammatory habit, will be more liable to suffer severely from the influence of small-pox. An intelligent writer has stated, from his own observation, that persons of a swarthy complexion, of a dry rigid fibre, not much disposed to perspire, with brown or black hair, which is of a strong texture and in great quantity, are more liable to a severe small-pox than those of a fair complexion, with thin, weak, and light hair, and who are moderately fat, but perspire freely. He remarks, too, that "persons afflicted with the palsy, ague, dropsy, and rickets, have commonly a favourable small-pox; and those afflicted with the two former frequently recover from both." (Roe on the Small-Pox, p. 57.) But the natural irritability may be much augmented or diminished by various circumstances, and thus the danger from the attack of small-pox in like manner increased or lessened. Thus, to use the words of the same author, "if a person should live intemperately, use violent exercise, drink much spirituous liquors, or give any occasion whatsoever to inflammation, before the attack of the small-pox, the disease will prove more virulent, although the natural habit be good. On the contrary, if a person be of an indifferent habit, and an unpromising temperament, but live temperately, eat little animal food, and lead a sober and sedentary life, before the disease attacks him, he bids fair for a happy recovery." We may add, that, upon the same principle, the adult age, as more robust and more connected with full living, is more liable to suffer the disease severely than childhood.

It seems, therefore, satisfactorily proved, "that an inflammatory state of the whole system, and more particularly of the skin," is the cause of the multiplication of the pustules, as well as of the other circumstances, which belong to the confluent small-pox, such as the early eruption, the erythematous rash, the continuance of the fever, the effusion of a more ichorous matter, and from thence the peculiar form, hue, incrustation, &c. of the pustules. See Cullen, First Lines, § 600.

Different causes have been assigned for the superior mildness of the disease, when produced by inoculation, over that which occurs in the casual way. Some have supposed that this advantage arose from having the choice of the matter of infection in the former case; and others have imagined that it was owing to the small quantity of matter which was introduced by the lancet. But from what has been said above, it is manifest that the choice of the matter is of

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no importance; and we know not how small a quantity is received when infection is communicated in the casual way. But it is very obvious, that, by avoiding the causes of an inflammatory diathesis, by lessening this condition when it exists, by shunning the concurrence of other diseases with the small-pox, and by choosing the proper season and time of life, we gain many advantages; and probably these were the principal advantages which inoculation possessed.

Seat of the Small-pox.—It has been a subject of much dispute, though easily determined by observation, whether the pustules of the small-pox affect the viscera and other internal parts. The most respectable testimony in favour of their existence internally, is that of Wrisberg, in the New Gottingen Commentaries, vol. lxxvi: but some others have also maintained that they had seen the pustules, upon dissection, upon the internal organs. There is no doubt, however, that such observations have originated in mistake. For all the dissections made by recent and more accurate anatomists have demonstrated, that, beyond the extension of the cuticle, no variolous pustules ever arise. Cotunnus, an Italian professor of anatomy, dissected above forty persons, who died of small-pox, for the express purpose of ascertaining what parts or organs were involved with the pustules. These examinations were conducted with great attention and accuracy, and in the presence of a number of students: and the result was, that, though the mouth, tongue, palate, and top of the pharynx, were often full of pustules, and in some few cases the internal membrane of the trachea was inflamed, and exhibited some effusion; yet not the least vestige of pustules was found upon any of the internal parts, even in the œsophagus. “Etenim quod spectat interiores partes,—certè non viscus, non membrana, non glandula, non pars demum interior ulla fuit, quæ in tot exemplis apparuerit pustulata.” (Cotun. de Sedibus Variolarum, § xxxix.) The truth is, as we have already observed, the pustules are little *cutaneous* abscesses, the result of inflammation in the skin alone, and not depositories of contagious matter distilling from the blood.

Diagnosis.—It is not easy, in general, to distinguish the fever, which is about to usher in the small-pox, from common simple fever, or from some other febrile diseases; since its early symptoms are not materially different from these. It may be presumed to be variolous fever, when the small-pox is a prevailing epidemic, provided the individual has not undergone the disease; and especially if he may have been in circumstances which rendered the communication of infection probable, or if his exposure to it were well ascertained. On children, the occurrence of a convulsive fit, on the evening of the second, or on the third day, will lead to a suspicion that the small-pox is about to appear. In all cases, however, this doubt will commonly be cleared up by the fourth day, when the small-pox will have appeared.

It is not easy to confound the eruption of small-pox with any other febrile eruption, except the chicken-pox, which, indeed, has not been demonstrated as a distinct disease more than fifty or sixty years. It had been called *variola spuria*, *bastard* small-pox; and even Dr. Heberden, who has the merit of having given the first clear description of the chicken-pox, (see Medical Transactions of the College of Physicians, vol. i. p. 433.) still applied the term *variola* to it; calling it *variola pusilla*. See his Commentarii de Morbis, cap. 96.

The eruption of small-pox is slower and of longer duration than that of chicken-pox, the latter being commonly completed in three days, and being covered with slight brown scabs on the fifth day, at which time the small-pox is at

the height of suppuration. The inflammation round the chicken-pox is very small, and the contents of them do not seem to be owing to suppuration, as in small-pox, but rather to what is extravasated immediately under the cuticle by the ferous vesicles of the skin, as in a common blister; whence this fluid appears in a vesicle on the second day, and, upon the cuticle being broken, is presently succeeded by a slight scab. On the third and fourth days, the shrivelled or wrinkled state of the vesicles which remain entire, and the radiating furrows of others, the ruptured tops of which have been closed by a slight incrustation, fully characterise the chicken-pox, and distinguish its eruption from the firm and durable pustules of small-pox. Another circumstance is also to be added to the diagnosis of these two diseases. If the whole eruption of chicken-pox on the face, breast, and limbs, be inspected on the fifth or sixth day, every gradation of the progress of the vesicles will appear at the same time, which cannot take place in the slow and regulated progress of the small-pox. (See Willan on Vaccine Inoculation, p. 95.) We have already noticed the difference in the sensation excited by touching the early eruption of the two diseases with the point of the finger, pointed out by the last-named author.

Since the introduction of the practice of vaccination, which may be deemed one of the greatest benefits ever conferred upon mankind by any individual, the diagnosis between small-pox and chicken-pox has, however, been rendered a little more difficult. For in several cases in which the small-pox has occurred in persons who had undergone the cow-pox (and we have seen that even small-pox and measles are not always securities against themselves), a mitigated and modified small-pox has commonly ensued, of a vesicular character, or of a small horny appearance, which has not gone through the usual stages; but, instead of proceeding to full suppuration, has begun to subside and dry away on the sixth day from the commencement of the eruption. It requires considerable attention, therefore, to discriminate between this variety of mitigated small-pox and the chicken-pox; and decision cannot always be obtained without the experiment of inoculation with the matter of the pustules. The impression under the finger, the form, and regular progress of the small-pox, may be generally recognized, however, up to the sixth day, by careful observation.

Treatment of Small-pox.—Until the year 1798, when Dr. Jenner immortalized his name by the announcement of his great discovery of the properties of the cow-pox, no means of prevention could be suggested to any individual, by which he could avoid or protect himself from the small-pox. In all large towns, and especially since the introduction of the practice of inoculation, a constant collection of contagion subsisted, which operated upon every one who visited them, even for a short time, from their more insulated situations in the country, if they remained susceptible of the disease. A preventive, however, is now discovered, and every one may be rendered secure from the influence of this baneful contagion. (See Cow-pox.) At present, however, this valuable preventive is not yet universally adopted, and the small-pox has carried off in this metropolis, during the year which has just terminated (1815), no less than one hundred and twenty-nine persons. We have still, therefore, occasion to study the best mode of treating the disease, under the different forms which it assumes, when it occurs in the casual way.

From a view of the history of the disease, as above detailed, it appears very evident, that the danger and violence of the symptoms are nearly in proportion to the quantity of the eruption; which is again much connected with the degree

gree of fever that accompanies and precedes it. The first indication, therefore, is, to moderate the eruptive fever.

In the case of inoculated small-pox, this process may be commenced in the interval between the insertion of the matter and the beginning of the disorder, that is, several days previous to the origin of the fever; when, by a light and cooling diet, and by the use of laxative medicines, if the habit be full, the body may be brought into a less inflammatory state; and thus rendered less susceptible of violent inflammatory disease. But in the casual small-pox, we have commonly no warning of the malady, until the eruptive fever actually commences; nor, when it has already begun, can we be certain, from any peculiar symptoms, that it is any thing but an ordinary fever; unless it occurs in persons who, not having previously undergone the disease, have been notoriously exposed to the infection. It is fortunate, however, that our inability to distinguish the fever which is about to usher in the small-pox from common inflammatory fever, is of no moment; since the same remedies are the most appropriate in both cases. The older practitioners, indeed, misled by their humoral hypotheses, about a fermentation in the blood, a struggle of the constitution to rid itself of the scum and dregs that were separated, and a salutary effort to discharge them by the skin, which was supposed to be manifest in the pustules, unfortunately took an opposite view of the subject. They thought it necessary to assist and encourage the fever, and very dangerous to repress it; and therefore they excluded the cool air, kept the patient in a hot bed, and administered warm drinks and cordial medicines. The pernicious influence of this practice (which was extended to all febrile complaints) was first detected by the sagacity of our great countryman, Sydenham, in spite of the hypothetical doctrines, in which he had himself been educated; and his prophecy, that, after his death, his opinion and practice would prevail, has been amply verified. In fact it is now universally admitted, that the more the previous fever is moderated, the more all the ensuing symptoms will be mitigated. According to the degree of violence with which the fever commences, the activity of the measures for moderating it will be various. If the symptoms are not severe, the patient may be recommended not to keep his bed, but to remain, according to the advice of Sydenham, in a cool apartment, having the benefit of cool air; and at the same time to discard animal food, and adopt that of a cooling nature, vegetable decoctions, acidulous fruits, and diluent drinks, such as plain cold water, lemonade, whey, &c. All his drinks should be given cold; and the bowels should be freely opened by some cooling purgative, as by the neutral salts, with a little calomel. If these measures are adequate to keep down the fever, and if, at the same time, the eruption appears early, and in small numbers, the safety of the patient may be considered as ascertained; and no farther treatment, except a continuance of the antiphlogistic system, is necessary. The practice of continuing to give purgatives as the eruption declines, appears to be altogether unnecessary, and may in some cases be hurtful; and it seems to be continued rather in compliance with the exploded hypothesis of separating the contagious matter from the blood, than from any rational inference of experience.

Where the fever comes on, however, with great violence, manifesting early its character, by a quick, hard pulse, intense heat, and thirst, a flushed countenance, inflamed eyes, severe head-ache, a quick and oppressed respiration, with delirium, especially in adult persons, and in those of vigorous or plethoric habits, very active measures should be immediately adopted. In persons of the latter description, the

first object would be to let some blood, the quantity of which must be determined by a consideration of the patient's age, constitution, and habits of life, and of the violence of the symptoms. At the same time, although he cannot obey Sydenham's injunction of sitting up, the cooling plan must be adopted to the fullest extent in respect to his apartment, which should be freely ventilated by the admission of the external air, through open windows and doors, and to his bed, which should be a mattress, and as lightly covered as the season and his feelings will permit. If the skin is intensely hot and dry, much benefit will be obtained, in the most expeditious manner, by sponging the surface occasionally with cold water, or even by the use of the cold affusion. We have known several instances, in which this fever, not being suspected to be the variolous fever, was treated by the cold affusion, with the most decided alleviation of the fever, and of the subsequent eruption. The benefits of this practice in scarlet fever, even during the extension of the eruption over the whole skin, are now generally acknowledged by all physicians who have witnessed the salutary and rapid change which it produces, both in the feelings and in the malady of the patient; being, in fact, the most efficacious physical agent, as well as the most expeditious and grateful, that the whole art of medicine is possessed of; and the only expedient fully entitled to the commendation of the ancient empiric, that of curing "*citó, tutó, et jucundé.*" It is, in truth, but the perfection of the cooling system recommended by Sydenham; and when united with cool air, cool drinks, and light coverings, it affords the most certain means of controlling the inflammatory fever.

An active purgative will also contribute to relieve inflammatory action, and should be speedily administered, and repeated according to circumstances. Diaphoretics are also recommended, and if they are not of a stimulating kind, they may be given with advantage: but the most effectual mode of inducing perspiration is by reducing the dry and burning heat of the skin, by cool air and washing.

If, however, these salutary measures have been omitted, or have proved inadequate to prevent a numerous eruption, especially upon the face; if the pustules are not distinct; and particularly, if, on the fifth day, the fever does not suffer a considerable remission; the disease will still require a great deal of attention. It will still be necessary to avoid heat and a heating regimen, and to continue to admit the free access of cool air, although the more active applications of cold, by sponging or affusion with water, need not be continued. The beneficial influence of cool and fresh air, indeed, at all periods of the disease, is very manifest; and in order to impress this truth more strongly, it may not be improper to relate a case or two, from among many that have been recorded, to shew the extent of that influence, even in the later stages. Sir George Baker, in his "*Enquiry into the Merits of a Method for inoculating the Small-pox, &c.*" observes, "*The history recorded by Sydenham, of a young man at Bristol, who owed his recovery to his being laid out on a table, as if dead, is sufficiently known. To this history there is a great resemblance in a case which is mentioned by Dr. Kirkpatrick, as having happened in Carolina. Mr. Benjamin Marych had a violent natural confluent small-pox in the hot weather. His attendants thought him dead; upon which the flashes were immediately set open, and a fresh quantity of air, or possibly a wind, rushing in, produced a fresh respiration and motion in the person who was thought dead. When this was observed, they went to put them down again. The patient who saw it, and was speechless, but sensible of the alteration*

SMALL-POX.

and benefit, beckoned with his hand to prevent them; and by degrees entirely recovered." Another case of the same kind is related by a gentleman of great veracity and experience. "In the year 1736, a man who lived as servant with Mrs. Broderop, one of the daughters of archbishop Wake, in Great Ormond-street, had the confluent small-pox; and on the evening of the fifteenth or sixteenth day, his life was entirely despaired of. On the next morning, when I went rather to enquire after him than to visit him, the nurse's report was, that he had grown worse and worse till two or three o'clock in the morning, at which time he ceased to breathe, became insensible and motionless, and appeared to be absolutely dead. About five or six o'clock, the body was removed and placed on a large table, near an open window, with no covering except only a shirt. No sign of life appeared, but the body continued hotter than is common after death. This heat, however, the nurse attributed to the weather. In this state he had remained about an hour, when the nurse heard a sort of sigh, or faint breathing; and it was observed that he had moved his arm across his stomach. Being raised up with some difficulty, he took a spoonful of a cordial medicine, ordered for him on the preceding day; and as soon as he was able to speak, he said the cold air was very refreshing. Being carried back to the bed, he fell into a sweat, and slept three or four hours. About this time I saw him. His pulse was now equal and strong; his respiration better than it had been for several days before; and his senses perfect. The door and windows were left open, and in a few days the man was quite out of danger." (See sir G. Baker's Essay, above quoted; and Dr. Walker's work on Small-pox.) These facts require no comment. They demonstrate the beneficial influence of cool air at all periods of the disease. It is, however, particularly beneficial at the period of which we are now speaking, when a thick eruption is coming out, and the fever does not remit. At this time the exposure to cool air, with the other antiphlogistic measures, will often greatly lessen the indistinct crowd of pustules that is spreading over the face, and occasion a few regular ones to arise, the head will lose its confusion, and the breathing become less oppressed,

At this period of the disease, too, under the same circumstances, it may be necessary, in adult and plethoric subjects, to take away some blood. This, however, seldom requires to be repeated. But a cooling purgative should be administered and repeated, or aided by a frequent repetition of laxative glysters; and the free use of diluent drinks should be permitted.

Most writers from Sydenham downwards, and Boerhaave and Cullen among the rest, have recommended the administration of an *opiate*, every night, under this febrile condition, that continues after the eruption of confluent small-pox has appeared. Sydenham, however, only gave it to patients whose age exceeded fourteen years: but Boerhaave and Cullen specify the fifth day as the time for the commencement of opiates, and mention no exception. It does not appear, that modern experience has confirmed the views of these great physicians: indeed, when Sydenham speaks of using opium or bleeding to effect the same purpose, we are unable to conjecture what powers he ascribed to the former remedy. "Jam non aliis auxiliis (cum in propinquo mors sit) ægro subveniri posse autumo, quam vel *narcotica* affatim exhibendo, vel *sanguinem* liberaliter *extrahendo*," &c. (Obs. Medicæ, sect. iii. cap. 2.) Dr. Walker has justly animadverted on this practice, which, however it may alleviate restlessness and pain, in slight cases, unaccompanied by acute fever, is well known to accelerate the circulation, to

harden the pulse, to augment the heat and thirst, to increase delirium, to diminish the secretions; in a word, to aggravate all the symptoms of inflammatory fever, while it fails to produce the anticipated rest, or rather banishes it more effectually. Such we know to be the effects of an opiate in all the *phlegmasiæ*, or acute and visceral inflammation; as well as in the active stages of common fever; and we know no circumstance in the early stage of small-pox, which constitutes any exception to this fact, or which modifies the ordinary operation of the medicine. A steady pursuit of the antiphlogistic plan is a much more effectual foothold of the irritation which the patient suffers. Sydenham and other writers urge the impropriety of interfering with the ptyalism, that usually occurs in confluent small-pox soon after the eruption is out, and deem the suppression of it highly dangerous. Yet the tendency of opium to lessen the secretions is well understood: but the principal injury to be apprehended from it is the excitement which it produces. In the later periods of the disease, however, when the febrile excitement is low, and much irritation is kept up by the hardening crusts, the moderate use of opiates is to be recommended.

The antiphlogistic practice, above recommended, should be continued during the progress of the eruption to maturation, unless some particular symptoms of failure of the *vis vite* should ensue. For in every case of small-pox, where the eruption of pustules is numerous, although some abatement of the fever is discernible upon the complete eruption of the spots, yet there is seldom a perfect remission of the fever, the pulse rarely descending below 90 or 100 in the minute. The *secondary fever*, therefore, which occurs about the eleventh day, upon the complete suppuration of the pustules, or at least when these are perfectly fall and stretched to their utmost extent, whatever may be the nature of the fluid which they contain, is rather an augmentation of the existing fever than a new fever. The origin of this fever, in the opinion of Sydenham and most of the writers who followed him, was the re-absorption of the virus of the pustules into the blood, as well as the retention of the ordinary perspirable matter, which could not pass off by the skin. Whence they recommended blood-letting, which, they believed, was the most effectual mode of depurating the blood thus contaminated, as the means of cure for this fever. But not only was their theory very bad, (for surely drawing a few ounces of blood from the circulating mass could have no effect in removing the corruption from that which remained in the vessels,) but their practice was often injurious, by reducing the strength of the patient, at a time when the powers of life were about to fail, and require all possible support. Dr. Freind had the merit of pointing out the superior advantages of gentle purgatives in mitigating the secondary fever. The bowels should be gently but steadily opened, in all cases, at the commencement of this fever, provided no diarrhoea has occurred. According to the state of the pulse, and the appearance of the matter in the eruptions, the strength of the patient, and other symptoms, more or less of a cordial plan of treatment must, however, be combined with the laxatives. Light liquid nourishment, with a little wine and water as drink, should be frequently administered; and a decoction or infusion of cinchona, with the mineral acids and a slight aromatic, will be given with advantage. If the disease put on a more malignant character, with petechiæ and hæmorrhages, the cordial treatment must be increased both in quantity and strength; but the state of the bowels must still be regulated. Under this cordial plan, the petechiæ will sometimes disappear; the empty vesicles will become filled with matter; and the ichorous fluid of others be changed into white thick pus;

pus; the other symptoms of course improving in a similar degree.

Such is the general plan of cure which experience has sanctioned in the small-pox. But in particular cases particular symptoms are very urgent, modifying the character of the disease, and requiring some modification of the method of treatment.

Little can be done to controul effectually the *salivation*, when that discharge is excessive, nor to restore it when it suddenly subsides. In the former case, and when the patient is in danger of suffocation from the viscosity of the saliva, and the difficulty of discharging it, the mouth and throat may be frequently washed or syringed with a gargle containing oxymel, or some of the mineral acids. And, as the saliva often begins to thicken on the eleventh day, Sydenham recommended a blister (which has been often found beneficial) to be applied between the shoulders, on the evening of the tenth day, by way of prevention. The *diarrhœa*, when it occurs spontaneously, being by all writers deemed rather salutary than injurious, should not be interfered with. The *swelling of the head, face, and fauces*, when it is excessive, is highly dangerous, and commonly accompanied by viscosity or suppression of the salivary discharge. The steady pursuit of the antiphlogistic system is the best preventive of this danger, and the free discharge occasioned by laxatives affords the best means of drawing off the determination of the fluids to those parts.

The *head-ache and delirium*, when violent and accompanied with intolerance of light, and other phrenitic symptoms, mark the violence of the fever from the beginning, as well as the too great fulness of the vessels of the head, and therefore demand, not only the most rigid pursuit of the antiphlogistic plan, the free admission of cool air, and active purgation, but also the particular application of cold to the head; the detraction of blood by leeches or cupping from the temples or nucha; or even general blood-letting. The pediluvium is sometimes recommended for the purpose of relieving the head on the principle of revulsion; but we have more than once expressed our doubts both of the truth of the hypothesis and of the advantages of the practice. When the determination to the head is such as to produce actual *coma*, during the eruptive fever, a most dangerous small-pox is to be apprehended; and the cooling evacuating measures just recommended should be carried as far as discretion and experience will justify, and a blister should be applied to the neck.

Inflammation of the throat is a common attendant on all the varieties of small-pox, even the mildest; but in the latter it is slight, and easily relieved by any acidulous and mucilaginous gargle, such as an infusion of figs, acidulated with lemon-juice, apple-tea, or lemonade. But the *angina*, which accompanies the worst kinds of small-pox, is more acute and obstinate, and from extending to the *glottis*, it frequently produces a considerable degree of hoarseness. It is also increased by the general inflammation and tumefaction of the contiguous parts, and continues till these subside. This symptom is moderated by the antiphlogistic regimen, by blood-letting in inflammatory habits, and especially by the early course of laxatives, which contribute to prevent and diminish all the inflammatory symptoms.

Difficulty of breathing is an alarming symptom in small-pox, and seldom occurs except in the worst kinds, and in the last stage of the disease, especially when it is left to nature, or improperly treated in the preceding periods. In cases where the chest is narrow and contracted, or there is a constitutional predisposition to disease in the lungs, this symptom may occur at an earlier stage. Its appearance

implies a threatening or present inflammation or peripneumony, and requires more than any other symptom the free use of blood-letting, as well as the exhibition of cooling purgatives, and the whole antiphlogistic plan.

Some degree of *suppression of urine* not unfrequently takes place in severe cases of small-pox, especially from bad management in the beginning of the disease; it is commonly attended by costiveness, and is most effectually relieved by promoting the intestinal discharge, especially by laxative glysters. An immediate evacuation is sometimes produced, as Sydenham remarked, by taking the patient out of bed, and supporting him exposed to the cool air in his shirt, but still more effectually by placing his feet on a cold floor or hearth, which commonly induces a speedy disposition in the bladder to contract and expel its contents.

It only remains that we allude to the means which have been devised to prevent the deformity which is too often produced by small-pox by the *pits* which it leaves behind. As the pits have been ascribed to the retention of the acrid matter under the cuticle, and the consequent corrosion of the true skin; so it has been proposed to open the pustules, in order to allow the ichor to be discharged. (See Van Swieten, Comment. ad Aph. 1402.) This plan, however, has not proved successful, and the theory is probably erroneous. Others have proposed the covering of the face in the last stage of the disease, to secure it from the air, and the use of fomentations at the same time with warm milk, and unctions with unsalted butter, hog's-lard, or oil. Dr. Walker, in his valuable work already often quoted, adopts a similar method, but at a somewhat earlier period. He maintains that the pits do not originate either from the acrimony of the contained matter, from ulceration, or from any loss of substance of the skin; but that they are, in fact, merely *impressions*, made in the tender skin by the pressure of the hardened and desiccated pustules, or scabs, as a seal impressed melted wax. This, however, may be justly questioned; for the skin, tender as it may be, is probably not capable of receiving any impressions so permanent, and must be partially ulcerated, and lose a portion of its substance by sloughing, under each hardening pustule. It is true, however, that the face is chiefly liable to be pitted, from the greater drying and hardening of the crowd of pustules which cover it, and that this may probably be owing to its greater exposure to the air. Whence the early prevention of such exposure, and the softening of the drying pustules, certainly promise the best security against severe pitting. About the tenth day of the disease, sometimes sooner, according to the kind of small-pox, the apices of the pustules on the face change colour, feel rough, and begin to harden, especially about the mouth and chin, which are more chafed by the bed-clothes. At this time, therefore, Dr. Walker spread over the face a mask, of fine old cambric, thinly smeared with a mild liniment, composed of oil, spermaceti, and a little wax. This mask he renewed three or four times in twenty-four hours, and sometimes oftener, especially when urged by the patient, who generally felt an agreeable and refreshing coolness for some time after each application. On removing the mask, the face was gently touched with a soft cambric handkerchief, and exposed to the air for as short a time as possible. By this expedient, he affirms, the variolous matter is seen through the transparent mask to be preserved in a state of fluidity as long as it remains in that state on other parts of the body, or until it is gradually discharged by oozing out. The mask is to be continued till the pustules are perfectly emptied, which happens in the course of ten, twelve, or fifteen days, and in some kinds of small-pox in a longer time. Dr. Walker

Walker affirms, "in the application of this theory of pits, in the varieties of small-pox that have come under my care, I have constantly found the above mode of treatment to answer my highest expectation, not only in preventing pits in the worst cases of this disease; but must observe an agreeable and unexpected effect, which I have constantly found to accompany it, namely, a preservation of the natural features. Many have experienced such an alteration in the countenances of their friends and children, from the effects of this disease, that they could scarcely know them again. This disagreeable effect has been completely prevented, in every case that I have met with, by the method above directed." (Loc. cit. p. 398.) He adds, however, that the success of this application stands connected with the antiphlogistic and evacuant plan of treatment, which he judiciously recommends, and which accords with that which we have above detailed.

In some constitutions, as we have already stated, the disturbance excited by the small-pox is such as to leave the patients in a state of great predisposition to disease, especially in the glandular system, and all the forms of scrofula are occasionally seen to follow its ravages, as well as some other cachectic conditions. One of the most formidable consequences, however, of confluent small-pox is the loss of sight, which it frequently occasions, and which is so common indeed in this country, that a large majority of the blind who are seen in the streets owe their loss of vision to the small-pox. This, however, is rather the result of the extension of inflammation to the eyes during the attack of the confluent small-pox, than a *sequela* of the disease, and therefore is to be prevented rather by the proper practice during the eruption above detailed, than by any subsequent treatment. With a view to anticipate the morbid consequences, upon the supposition that they arise from the remains or dregs of the contagion still contaminating the blood, it is usual to administer a succession of purgatives, to clear the circulating fluids of these impurities. We do not profess to understand how, by exciting the actions of the exhalents of the intestines, we can draw out of the blood just the impure portion, leaving the rest unpolluted; and consider both the contamination and the purification of the blood as equally gratuitous suppositions. Where the patient comes out of the disease with every appearance of returning health, we do not perceive the necessity of resorting to these hypothetical cleansers, which, if violent, may do harm, and can only be productive of benefit by assisting the digestion and propulsion of the aliments in a gentle way. And where there are appearances of a bad habit of body, or a slow convalescence, more advantages are probably to be obtained by a proper attention to diet and regimen, with a judicious course of alterative and gently tonic medicine, than by the repetition of cathartics. A diet of milk and vegetables, or very light animal fluids, with appropriate exercise, change of air, the tepid bath, and other means which medicine affords of regulating the functions and gradually restoring the strength, should be pursued with diligence, especially where there is a disposition to hectic fever connected with the debility. Some forms of scrofula and cachexia, however, which are more local and unaccompanied by fever, require a more nutritious and cordial plan of treatment, to be determined by the age and other circumstances of the patient.

An able and ingenious project was proposed several years ago by Dr. Haygarth for the extermination of small-pox in Great Britain, turning upon the principle of a general inoculation. (See his *Sketch of a Plan*, &c. in 2 vols. 1793.) It is unnecessary, however, now to enter into any discussion

respecting the efficacy or importance of such a plan; since the discovery of the influence of the cow-pox, by the immortal JENNER, has afforded us an antidote, which requires only a general adoption to supersede altogether that fatal and formidable malady, and to preserve mankind from all the miseries and evils which it has spread over the earth for many centuries past. See COW-POX and INOCULATION.

SMALLS, THE, in *Geography*, rocks in the Irish sea, on which a light-house is erected for the guidance of seamen, about 15 miles S.W. from St. David's Head. N. lat. 51° 44'. W. long. 5° 33'.

SMALRIDGE, GEORGE, in *Biography*, a learned English prelate, was the son of a dyer at Litchfield, in which city he was born in 1663. He was educated at Westminster school, where his fine talents and excellent disposition rendered him a general favourite. In 1682 he was elected to a student's place in Christ's college, Oxford, in which he became in due time a tutor; and his reputation caused him, at an early age, to be selected, with others, as managers of the controversy with Obadiah Walker, master of the University college, a convert to popery. In this connection he published, in 1687, "Animadversions on the Eight Theses laid down, and the Inferences deduced from them, in a Discourse entitled 'Church Government,'" &c. About this period he distinguished himself as a votary of polite literature, of which he gave specimens in the "Musæ Anglicanæ." He entered into holy orders in 1692, and was appointed minister of Tothill-fields chapel, and he also obtained a prebend in the cathedral of Litchfield. In 1700 he took the degree of D.D., and frequently acted as deputy to Dr. Jane, regius professor of divinity at Oxford. On the death of Dr. Jane, in 1707, he was strongly recommended by the university for his successor; but the Whig interest carried it against him. Being now a celebrated preacher, he was chosen, in 1708, lecturer of St. Dunstan's in the West, London, and he was also appointed a member of the lower house of convocation, and exerted himself very much to procure for his friend, Dr. Atterbury, the prolocutor's chair, on which occasion he pronounced an elegant Latin panegyric on his friend, touching with much feeling and delicacy, as an apologist, upon the heat in controversy imputed to him. Dr. Smalridge, though of the party, avoided the animosities too prevalent in its disputes. He held also a friendly correspondence with Dr. Clarke and Whiston, and was extremely useful in moderating the violent proceedings instituted by the convocation against them. He assisted Whiston in his translation of the Apostolical Constitutions. He proposed a conference with Dr. Clarke on the subject of the Trinity, which was held at the seat of Mr. Cartwright, at Aynho, in Northamptonshire, and in which Dr. Smalridge was the advocate of orthodoxy. These connections caused him to be suspected of an inclination towards Arianism, from which he deemed it necessary to vindicate himself by a letter to bishop Trelawny, a short time before his death. In 1711, Dr. Smalridge was made a canon of Christchurch, Oxford, and afterwards dean of Carlisle. When Dr. Atterbury was promoted to the bishopric of Rochester in 1713, his friend succeeded him as dean of Christchurch. In the following year he was raised to the episcopal bench as bishop of Bristol, and very soon after he was nominated lord-almoner to queen Anne. Upon the accession of George I. he refused to sign the declaration made by some of the bishops, on occasion of the rebellion in 1715, because it contained a reflection on some of the clergy who had joined the Jacobites. This step caused the post of almoner to be taken from him, but he possessed the esteem of the princess of Wales, afterwards queen Caroline, with whom he continued in favour till

till his death, which happened in 1719, at Christchurch, where he was interred, and where, some years after, a handsome monument was erected to his memory, with an elegant Latin inscription. He left a widow and two children, who were much befriended by the generosity of the prince of Wales. A collection of 60 of his sermons was printed after his death, which soon came to a second edition. Biog. Brit.

SMALT, the last produce of cobalt, a kind of mineral matter, prepared and purified abroad, and brought hither, sometimes in form of a blue powder, and sometimes in lumps; chiefly used along with starch, to give linens the finer and clearer cast; and best known by the name of powder-blue. See **COBALT**.

The preparation of smalt, as practised in Hermanduria, we find described in the Philosophical Transactions by Dr. Krieg; who tells us, that the matter it is made of is the mineral stone called cobalt, or *cadmia mineralis*; which being pulverized, and the lighter stuff washed away, the remainder is laid on a furnace, and by a fire underneath and aside it, the flames of which are reverberated over it, a matter is separated from it in form of a smoke; which, sticking to the walls, makes what we call arsenic.

When the cobalt has done smoking, it is cooled, mixed with pot-ashes and powder of white flint-stones; the mixture is put in pots, and melted for five or six hours in a furnace. By this means, the matter is formed into a blue glass, which being put in cold water, cracks and grows tender; and is, at length, powdered by an engine, the finest part separated by a sieve, put into a mill, and ground in water into a very fine powder; which, by washing, is still farther separated from the coarser, then dried in warm chambers, barrelled up, and sent away.

There is not a more precarious process in all metallurgy than the preparation of this fine blue glass from cobalt, nor any manufacture in which so expert workmen are necessary. The carrying the heat to too great a degree, in the roasting of the cobalt, is a very mischievous error; and the suffering as much of the arsenic as may be to remain in the earth, is greatly to the advantage of the smalt; and its colour may be greatly heightened by adding common arsenic to it while it is in fusion.

It is always necessary to make careful and repeated experiments on a new ore, or a kind of cobalt which has not been worked before; by trying it with various degrees of heat in the roasting, and with different proportions of the flints and pot-ash in the fusion. On comparing the several products of these experiments, it will easily be seen which yields the finest colour, and this must be always after followed in the great operations.

It is well known, that the beautiful blue glass, called smalt, is prepared from the fixed earth of cobalt; but experiments have proved, that this earth alone will not acquire that fine colour. Dr. Link tried some of it, by keeping it eight hours in the most intense heat; yet on taking it out, it was only a grey glass, excepting that there were a few blue specks in it near the edges of the crucible. These specks make no objection to this doctrine, when properly considered; for they were owing, doubtless, to the same substance which is found necessary to be used, in order to procure the blue colour.

Flints are the necessary addition to cobalt for the making of the blue glass, or smalt; and the crucible being made of earth, might easily contain some particles of sand. Every piece of sand is a small stone, of the nature of flint; that is, a piece of crystal defaced by earth; and these small flints mixing with the glass of the cobalt earth, while in fu-

sion, rendered the small specks, where they were mixed, true smalt, while the rest remained grey and unaltered.

This earth of cobalt evidently contains some portion of copper, though so small in quantity, that it can never be discerned by the common signs, and so intimately blended with the earth, that it can never be procured separate. The lightness of this earth also, in which the copper refides after the sublimation of the arsenic, is a proof that its quantity must be very small; yet that it exists there is evident from the colours it affords.

Copper is well known to yield a green colour with acids, and a fine blue with alkalis. Thus, a solution of this earth in aqua fortis is of a deep green, and its glass, when mixed with the alkali of flints and of pot-ash, is the deep blue smalt: nor is it wonderful, that the vitrified earth of cobalt will never become blue by calcination alone, since, if it owes this colour to copper, it cannot be supposed to shew itself till called forth by an alkali.

Some cobalt yields smalt before roasting, even better than it would afterwards: this is a peculiar kind of cobalt, but is so like the rest, that it cannot be distinguished by the eye; but experiment alone shews this property in it.

Though cobalt in general requires roasting, in order to fit it for yielding the smalt, yet its different kinds require some more, and some less roasting; and the degree can never be judged of by the inspection of the mineral, but is only known by the experienced art in the process. Hence it is, that expert and intelligent persons are necessary in the smalt-works more than in almost any other branch of this sort of business.

The addition of a small quantity of arsenic, or of the arsenical flowers, during the time that the smalt is in fusion, adds greatly to the beauty of the colour: this is a practice kept secret by the workmen of some places; and by this means their smalt is always rendered better than that of their neighbours.

It is easy to see from this, that the roasting of cobalt is the necessary beginning of the smalt-work, not the divesting it of its arsenic, which only happens accidentally in that process; and it would be much better if it did not happen, since we find the arsenic added afterwards exalts the colour. From hence it is evident, that those cobalts which will make smalt without previous roasting, must, as they are found to do, make the very finest smalt, because their arsenic is yet left in them in great part; and from this also appears the necessity of having expert workmen for the smalt-making; since the knowing the degree of fire necessary to the ore is a most essential article, and after the roasting has been carried to a sufficient degree, every moment's heat divesting it of more of its arsenic than was necessary, makes the colour of the smalt to be made afterwards so much the worse. From this also appears the reason why the blue, made by precipitation from a solution of cobalt, is so much superior to the common smalt made by fire; because in this the arsenic is all preserved, whereas, in the common way of preparing it by fire, it is driven off. *Philos. Trans. N^o 396.* See **AZURE** and **ZAFFRE**.

SMAMLEVO, in *Geography*, a town of Russia, in the government of Viatka, on the Kama; 16 miles S. of Sarapul.

SMARA, a name of Kama, the Hindoo cupid. (See **KAMA**.) Smara means the ideal, and in the fanciful mythology of the East, is the reputed son of Maya, or illusion. See **MAYA**.

SMARAGD, *σμαραγδος*, a precious stone of a green colour, very beautiful and brilliant; called also the *emerald*; which see. See also **GEMS**.

SMARAGDUS MONS, in *Ancient Geography*, a mountain of Egypt, on the coast of the Arabic gulf, between Nechofia and Lepte Extrema, according to Ptolemy.

SMARIS, in *Ichthyology*, the name of a small fish caught in the Mediterranean, and common in the markets of Rome, Venice, and elfewhere, and fold to the poorer fort of people at a very small price. This, in the Linnæan fyftem, is a fpecies of the *fparus*; which fee.

It is feldom of more than a finger's length, and of a round, not flattened body, of a dusky blackifh-green on the back and fides, and not marked with any variegations, but having on each fide, near the middle of the body, one large black spot; its gill-fins and tail are of a faint red; the iris of the eyes is of a brownifh-white, and the tail is forked.

SMART, PETER, in *Biography*, a native of Warwickfhire, was educated at Weftminfter fchool, from whence he removed to Oxford, and became a ftudent of Chriftchurch. After entering orders, he obtained a prebend in Durham cathedral, where he diftinguifhed himfelf by his oppofition to the ceremonies in religion, and the removal of the altar from the middle of the choir to the eaft end of the church. He preached and printed fome fermons on the vanity and downfall of fuperftition and popifh ceremonies, for which he was degraded from the miniftry, and imprifoned. He died in 1642. He was likewife author of poems, Latin and Englifh

SMART, CHRISTOPHER, a confiderable poet, born in April, 1722, at Shipbourne, in Kent, was educated at Maidftone and Durham fchools, and at the age of feventeen he was entered at Pembroke Hall, Cambridge. By the death of his father his affairs were embarrassed, but his fpirits were not weighed down by family miffortunes, and while he was the companion of the gay, he cultivated the Mufes, and obtained great credit and feveral academic prizes for his college exercifes. His talents, however, were not adapted to augment the means of fubfiftence, and at length his diftreffes were fo great as to produce a derangement of his mental faculties. He died in 1771, leaving behind him a widow and two daughters, who fettled as bookfellers at Reading. His works confift of fables, fonnets, odes, prize-poems, &c. printed at Reading, in 2 vols. 12mo. 1791. He publifhed a profe tranflation of the works of Horace, and tranflations in verfe of the Pfalms, and of the fables of Phædrus. As a poet, he poffeffed a large fhare of originality; was fometimes very pathetic; and, according to his biographer, he fometimes reached the true fublime.

SMART-Weed, in *Agriculture*, a term applied to the biting or pale-flowered perficaria, or arfmart, which is a troublefome weed in arable land.

SMATCH, in *Ornithology*, a name by which the common oenanthe is called in many parts of England.

SMEAR-DAB, in *Ichthyology*, is a name given to a fpecies of dab among the fifhmongers of London, which is of equal goodnefs with the common dab.

SMEATON, MARK, in *Biography*, a mufician in the fervice of Anna Bullen, and groom of her chamber, whom Henry VIII. in a fit of jealousy, or pretended jealousy, accused of familiarity with his queen. The mufician, in the vain hope of life, was prevailed on to confefs a criminal correpondence with his royal miftrefs; "but even this unfortunate queen's enemies expected little advantage from this confeffion, for they never dared confront him with her." Hume's Hift. Hen. VIII. chap. v.

"The queen faid, he was never in her chamber, but when the king was lalt at Winchefter; and then he came in to play on the virginals. She faid, that fhe never fpoke to him after that, but on Saturday before May day, when fhe

faw him ftanding in the window, and then fhe asked him, why he was fo fad? he faid, it was no matter: fhe answered, you may not look to have me fpeak to you, as if you were a nobleman, fince you are an inferior perfon. No, no, madam, faid he, a look fufficeeth me." BARNET'S Hift. of the Reform. vol. i. book iii. p. 199.

SMEATON, JOHN, an eminent civil engineer, was born on the 28th of May, 1724, at Aulthorpe, near Leeds. The ftrengh of his underftanding, and the originality of his genius, appeared at an early age; his playthings were not the playthings of children, but the tools which men employ; and when he was a mere child, he appeared to take greater pleafure in feeing the operations of workmen, and asking them queftions, than in any thing elfe. Before he was fix years old, he was once difcovered at the top of his father's barn, fixing up what he called a wind-mill of his own conftruction; and at another time, while he was about the fame age, he attended fome men fixing a pump, and obferving them cut off a piece of the bored part, he procured it, and actually made a pump, with which he raifed water. When he was under fifteen years of age, he made an engine for turning, and worked feveral things in ivory and wood, which he prefented to his friends. He made all his own tools for working in wood and metals, and he conftructed a lathe, by which he cut a perpetual fcrew in brafs, a thing but little known, and which was the invention of Mr. Henry Hindley of York, with whom Mr. Smeaton became acquainted, and indeed extremely intimate. Mr. Smeaton, by the time that he was eighteen years of age, acquired, by the ftrengh of his genius and indefatigable induftry, an extenfive fet of tools, and the art of working in moft mechanical trades, without the affiftance of a mafter. A part of every day was ufually occupied in forming fome ingenious piece of mechanism. His father was an attorney, and being defirous to bring up his fon to the fame profeflion, he brought him up to London with him in 1742, and attended the courts in Weftminfter-Hall; but after fome time, finding that the law was not futed to his difpofition, he wrote a ftong memorial to his father on the fubject, who immediately defired the young man to follow the bent of his inclination. In 1751 he began a courfe of experiments to try a machine of his own invention to meafure a fhip's way at fea, and alfo made two voyages, in company with Dr. Knight, to try the effect of it, and alfo for the purpofe of making experiments on a compafs of his own conftruction, which was rendered magnetical by Dr. Knight's artificial magnets. In 1753 he was elected a fellow of the Royal Society; and the number of papers which he publifhed in their Tranfactions, will fhew how highly he deferved the honour of being enrolled a member of that ufeul and important body. In 1759 he received from the council of the Royal Society, by an unanimous vote, their gold medal for his paper, entitled "An experimental Inquiry concerning the natural Powers of Water and Wind to turn Mills and other Machines, depending on a circular Motion." The paper was the refult of experiments made on working models in the years 1752 and 1753, though not communicated to the fociety till 1759; and in the interval he had opportunities of carrying into effect feveral of his inventions and theories, which rendered his paper of much more real value to the fociety and the public at large. In 1755, the EDDYSTONE Light-houfe was burnt down (fee the article), and Mr. Smeaton being recommended to the proprietors of that building as an engineer in every way calculated to rebuild it, he undertook the work, which was completed in 1759, much to the fatisfaction of the parties concerned. Still he was not fully employed as a civil engineer, for in the

year 1764, while he was in Yorkshire, he offered himself as a candidate for the office of receiver to the Derwent water estate; and in the course of the year he obtained the appointment in a manner most flattering to himself, inasmuch as his own merit carried the point in opposition to two other candidates who were strongly recommended and powerfully supported. He was very happy in this appointment, particularly in the assistance which he received from Mr. Walton, the other receiver, who took upon himself the management of the accounts, leaving Mr. Smeaton leisure and opportunity to exert his abilities on public works. In the year 1773, he had so much business as a civil engineer, that he wished to resign this appointment; but his friends prevailed on him to continue in office two years longer. After this, Mr. Smeaton was employed on many works of great public utility. He made the river Calder navigable, a work that required talents of the very first order, owing to the impetuous floods in that river; he planned and attended to the execution of the great canal in Scotland, for conveying the trade of the country either to the Atlantic or German ocean; and as a proof of the disinterestedness of his habits, having brought it to the place originally intended, he declined a handsome yearly salary, in order that he might attend to other business. On the opening of the great arch at London-bridge, the excavation around and under the starlings was so considerable, that the bridge was thought to be in great danger of falling. Mr. Smeaton was then in Yorkshire, and was sent for express, and he arrived without any delay. "I think," says his biographer, "that it was on a Saturday morning when the apprehension of the bridge was so general, that few persons would venture to pass over or under it. Mr. Smeaton applied himself immediately to examine it, and to sound about the starlings as minutely as possible, and the committee being called together, adopted his advice, which was to repurchase the stones that had been taken from the middle pier, then lying in Moorfields, and to throw them into the river to guard the starlings. In this way Mr. Smeaton probably saved London-bridge from falling, and secured it till more effectual methods could be adopted."

Mr. Smeaton was appointed engineer to Ramsgate harbour, and brought it into a state of great utility by various operations, of which he published an account in 1791. The variety of mills which Mr. Smeaton constructed, shews the great uses which he made of his experiments already referred to; for it was a rule with him, from which he never willingly deviated, not to truit to theory in any case, where he could have an opportunity to investigate a subject by real trial. He built a steam-engine at Aulthorpe, and made a vast number of experiments with it to ascertain the power of Newcomen's engine (see STEAM-Engine), which he improved and brought to a far greater degree of perfection, both in its construction and powers, than it was before. Mr. Smeaton, during many years of his life, was a frequent attendant upon parliament, his opinion on various works begun or projected being continually called for. And in these cases the strength of his judgment and perspicuity of expression had full scope. It was his constant custom, when applied to plan or support any measure, to make himself fully master of the subject, to understand its merits and probable defects, before he would engage in it. By this caution, added to the clearness of his expression, and the integrity of his heart, he seldom failed to obtain for the bill which he supported the sanction of an act of parliament. No one was ever heard with more attention, nor had any one ever more confidence placed in his testimony.

In the courts of law he had several compliments paid him from the bench by lord Mansfield and other judges, for the new light that he always threw upon difficult subjects. About the year 1785, the health of this excellent man began to decline, and he took the resolution to avoid all the business he could, in order that he might have leisure to publish an account of his inventions, improvements, and works, by which he conceived he should be doing a public benefit to his country and the world. In September 1792, he had a paralytic seizure, which put a period to his life in about six weeks.

Mr. Smeaton had a warmth of expression that might appear to those who did not know him, to border upon harshness, but those more intimately acquainted with him knew that it arose from the intense application of his mind, which was always in the pursuit of truth, or engaged in some difficult subjects. If he were sometimes apparently hasty and impetuous in his disposition, he would always listen to reason, and yield to the force of argument.

In all the social duties of life he was exemplary: his manners were simple, and his mode of life abstemious. He was singularly moderate in his pecuniary concerns. He was fond of science for its own sake, and spent much of his leisure in cultivating that of astronomy; for which purpose, he fitted up an observatory in his house, furnished with curious contrivances of his own invention. He was a friend and encourager of merit wherever he discerned it, and many persons were indebted to him for important assistance on their entrance into life. Mr. Smeaton was the institutor, in 1771, of a society of civil engineers, which was dissolved at his death, but afterwards renewed; they published, in 1797, a volume of his Reports. For his works in constructing bridges, mills, harbours, engines, &c. see his Reports, in 3 vols. 4to. Of his inventions and improvements of philosophical instruments, an idea may be formed from the list of his writings which is inserted in Hutton's Dictionary.

SMECTIS, in *Natural History*, a name used by several authors for the common fuller's-earth, more commonly called *cimolia purpurascens*.

SMECTYMNUUS, a cant term that made some figure in the time of the civil war, and during the Interregnum. It was formed of the initial letters of the names of five eminent Presbyterian ministers of that time, viz. Stephen Marshal, Edmund Calamy, Thomas Young, Matthew Newcome, and William Spurflow: who, together, wrote a book against episcopacy, in the year 1641, whence they and their retainers were called Smectymnuans.

SMECZNA, in *Geography*, a town of Bohemia, in the circle of Schlan; 3 miles S. of Schlan.

SMEGMA, a kind of wash in use among the ancients. See DETERSORIUM.

SMEGMADERMOS, in *Botany*. See SMEGMARIA.

SMEGMARIA, judiciously abbreviated by Willdenow, from *Smegmadermos*, the name originally given to this genus, by the authors of the *Flora Peruviana*; which, being composed of *σμύγμα*, soap, and *δέρμα*, skin, alludes to the use made of the bark in washing,—"Ruiz et Pavon Prodr. 144. t. 31." Willd. Sp. Pl. v. 4. 1123.—Class and order, *Polygamia Diocia*, Willd. More properly, as we presume, *Decandria Pentagynia*. Nat. Ord. allied to *Rutaceæ* of Jussieu.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, coriaceous, downy, in five deep, ovate, equal segments, permanent. *Cor.* Petals five (not six), obovate, the length of the calyx, alternate with its segments; their claws slender. Nectary of five orbicular, smooth, depressed lobes, opposite to, and

lying upon, the segments of the calyx, and about half as long. *Stam.* Filaments ten, awl-shaped, smooth, the length of the calyx, five of them inserted into the receptacle, five into the nectaries; anthers incumbent, nearly orbicular, of two cells bursting in front. *Pist.* Germe superior, small, roundish, villous, in five distinct lobes; styles five, vertical, erect, cylindrical, smooth, shorter than the stamens; stigmas small, obtuse. *Peric.* Capsules five, spreading in the form of a star, obovate, coriaceous, of one cell and two valves. *Seeds* several, winged.

Eff. Ch. Calyx five-cleft. Petals five. Nectary of five orbicular depressed lobes, opposite to the calyx, alternate with the petals, and bearing five of the stamens. Capsules five, superior. Seeds numerous, winged.

1. *S. emarginata.* Chili Soap-bark. (*Smegmadermos emarginatus*; "Raiz et Pavon. Syst. Veg. v. 1. 288. Quillaja fapanaria; Molin. Chil. ed. Germ. 150.")—Native of woods in Chili, about Puchacay, where it is known by the name of *Quillay*. Our specimen was sent by the late abbé Cavanilles. The tree is said to be twenty ells in height, bearing abundance of leafy branches, which are round, much subdivided, knotty, finely downy when young. *Leaves* an inch long, alternate, on short broad stalks, broadly elliptical, obtuse, coriaceous, evergreen, smooth, shining, veiny, entire in our specimen, though reported to be sometimes toothed. *Stipulas* minute, awl-shaped, membranous, in pairs, deciduous. *Flowers* few together, on axillary or terminal, short, downy stalks. *Calyx* expanding more than half an inch, thickly clothed all over with short, dense, white pubescence, as in *Grewia* and *Tilia*, to which we at first suspected this genus might be allied; as perhaps is the case, though it will not answer to Jussieu's definitions of his *Tiliaceæ*, or indeed any other order. The petals are probably white or pink, but of this we have no information. *Capsules* near an inch long, externally downy; their inner coat smooth, cracking transversely with age, but we can discern nothing like the separate elastic tunic of the true *Rutaceæ*.—Nothing but error and inconvenience can result from placing this genus in the class *Polygamia*.

SMELBURG, in *Geography*, a town of the duchy of Warfaw; 50 miles N. of Gnesna.

SMELL, ODOR, with regard to the organ, is an impression made on the nose by little particles continually exhaling from odorous bodies.

SMELL, with regard to the object, is the figure and disposition of odorous effluvia, which, sticking on the organ, excite the sense of smelling.

SMELL, with regard to the soul, is the perception of the impression of the object on the organ; or the affection in the soul resulting from it.

Smell, like taste, consists altogether in the arrangement, composition, and figure of the parts, as appears from the following experiments of Mr. Boyle.

1. From a mixture of two bodies, each of which is, of itself, void of all smell, a very urinous smell may be drawn: this is done by the grinding of quicklime with sal ammoniac.

2. By the admixture of common water, which of itself is void of smell, or inodorous, another inodorous body may be made to emit a very rank smell. Thus, camphor dissolved in oil of vitriol is inodorous, yet mixed with water it immediately exhales a very strong smell.

3. Compound bodies may emit smells, which have no similitude to the smells of the simples of which they consist. Thus, oil of turpentine, mixed with a double quantity of oil of vitriol, and distilled; after distillation, there is no smell but of sulphur; and what is left behind in the retort, be-

ing again urged by a more violent fire, yields a smell like oil of wax.

4. Several smells are only to be drawn forth by motion and agitation. Thus, glass, stones, &c. which, even when heated, yield no smell; yet, when rubbed and agitated in a peculiar manner, emit a strong smell: particularly beechwood, in turning, yields a kind of rosy smell.

5. A body that has a strong smell, by being mixed with an inodorous one, may cease to have any smell at all. Thus, if aqua fortis, not well dephlegmated, be poured on salt of tartar, till it cease to ferment; the liquor, when evaporated, will yield inodorous crystals, much resembling nitre; yet these, when burnt, will yield a most noisome smell.

6. From a mixture of two bodies, one of which smells extremely ill, and the other not well, a very pleasant aromatic odour may be gained, viz. by a mixture of aqua fortis, or spirit of nitre, with an inflammable spirit of wine.

7. Spirits of wine, by mixing with an almost inodorous body, may gain a very pleasant aromatic smell. Thus, inflammable spirits of wine and oil of Dantzic vitriol, mixed in equal portions, then digested, and at last distilled, yield a spirit of a very fragrant smell.

8. A most fragrant body may degenerate into a fetid one, without the admixture of any other body. Thus, if the spirit mentioned in the former experiment be kept in a well-closed receiver, it will soon acquire the rankness of garlic.

9. From two bodies, one of which is inodorous, and the other fetid, a very pleasant smell may arise, much resembling musk, viz. by putting pearls into spirit of vitriol; for, when dissolved, they yield a very agreeable smell. See SMELLING.

SMELL is used as a name for a peculiar sort of wine, of which there are two species; the one sort is very fragrant, muscatelline, and aromatic; this is called simply the *smell-wine*: but the other, which is very rank and offensive to the nose, is called by the Germans *smell-bruntzer*. Many have been the conjectures about the occasion of the rank smell of this wine.

The smell is truly urinous, and is that of a volatile alkali; which not being embodied in, or subdued by the acid of the grape in this imperfect fermentation, vents itself in this rank manner.

It is evident, that the smell is of a volatile nature, for it is often lost in the drawing of the wine several times out of one vessel into another, evaporating during the time of drawing it out.

SMELLIE, WILLIAM, M.D., in *Biography*, an eminent teacher and practitioner of midwifery, was a native of Scotland. After having successively practised this art in a small town of that country for a period of nineteen years, he removed to London, and in 1741 was living in Pall-Mall, where Dr. William Hunter resided with him. This circumstance implies, that he had already risen to considerable eminence in his line, and he was in fact in high repute as a lecturer, being attended by a numerous concourse of pupils of both sexes. This reputation, indeed, he appears to have merited by his talents and assiduity; for he was the first in proposing many of the practical improvements, which modern experience has admitted into the practice of midwifery, and by his mechanical skill he contributed materially to the improvement of the instruments employed to facilitate delivery in difficult cases, and to the disuse of those which were less safe and convenient; and he established some useful rules for their application. He was the first writer, who, by accurately determining the shape and

size of the pelvis, and of the head of the fœtus, and comparing their proportions, and the true position of the fœtus in utero, pointed out clearly the whole progress of the child during parturition: and his opinions were subsequently confirmed, especially by Dr. Hunter, from observations made after death, where parturition had not been completed. The improvement which he made in the forceps, which has since been universally adopted, is well known, and he taught the present manual mode of using them. He abolished many superstitious notions and erroneous customs that prevailed in the management of parturient women and of the children; and he had the satisfaction to see the greater part of his maxims adopted, not only in this island, but by many of the most respectable practitioners in Europe.

In the year 1752, he published the substance of his lectures, in the improvement and correction of which he affirms, that he had spent six years, in one volume 8vo., under the title of "A Treatise on Midwifery;" to which, in 1754, he added a second volume of cases, intended to illustrate the precepts laid down in the former. An additional volume of cases, which he promised in his preface, did not appear till about five years after his death, in 1768. The whole formed the most complete system of the art of midwifery, which had then appeared, and was regarded as the best authority: it was, in fact, the result of an extensive experience of forty years, and contained a very comprehensive view of the various circumstances that usually occur, with instructions respecting the best means of obviating them. In 1754, Dr. Smellie likewise published a set of anatomical plates, of a large folio size, and thirty-six in number, which were intended farther to elucidate the doctrines of his lectures. In eleven of these he acknowledges the assistance of the late professor Cowper. Like other ingenious men of original character, Dr. Smellie was assailed by some critics and opponents, especially by Dr. Burton of York, and by Dr. W. Douglas, with great acrimony; but he ever maintained the character of a man of ingenuity and judgment; he was remarkably candid and modest in his demeanour, and upright and disinterested in all his concerns. His reputation and success were the result of his merit alone; for his awkwardness of person and unpolished manners prevented him from rising to the highest line of practice; but he was much esteemed by his pupils, and by those who employed him. He ultimately retired to Lanark, where he spent the latter years of his life, and died in 1763, at an advanced age. Hutchinso[n] Med. Biog. Gen. Biog.

SMELLING, the act whereby we perceive smells, or by which we become sensible of odorous bodies, by means of certain effluvia, which, striking on the olfactory organ, briskly enough to have their impulse propagated to the brain, excite a sensation of the soul.

The principal organs of smelling are the nostrils and the olfactory nerves; the minute ramifications of which latter are distributed throughout the whole concave of the former. See **NOSE**.

Smelling is performed by the odorous effluvia, floating in the air, being drawn into the nostrils, in inspiration, and struck with such force against the fibrillæ of the olfactory nerves, which the figure of the nose, and the situation of the little bones, render opposite thereto, as to shake them, and give them a vibratory motion; which action, being communicated hence to the common sensory, occasions an idea of a sweet, or fetid, or sour, or an aromatic, or a putrefied object, &c.

The matter in animals, vegetables, fossils, &c. which chiefly affect the sense of smelling, Boerhaave observes, is that

subtile substance, inherent in the oily parts of them, called *Spirits*: because, when this is taken away from the most fragrant bodies, what remains has scarcely any smell at all; but this, poured on the most inodorous bodies, gives them a fragrantcy.

Willis observes, that brutes have, generally, the sense of smelling in much greater perfection than man; as by this alone, they distinguish the virtues and qualities of bodies unknown before; hunt out their food at a great distance, as hounds and birds of prey; or hid among other substances, as ducks, &c.

Man, having other means of judging of his food, &c. did not need so much sagacity in his nose; yet have we instances of a very considerable degree of it, even in man. In the *Histoire des Antilles*, we are assured, there are Negroes, who, by the smelling alone, can distinguish between the footsteps of a Frenchman and a Negro.

It is found that the laminae, with which the upper part of the nostrils is fenced, and which serve to receive the divarications of the olfactory nerves, are always longer, and folded up together in greater numbers, as the animal has this sense more accurate: the various windings and turnings of these laminae detain and fetter more of the odoriferous particles.

The sense of smelling may be diminished or destroyed by diseases; as the moisture, dryness, inflammation or suppuration of the olfactory membrane, the compression of the nerves which supply it, or some fault in the brain itself at their origin. A defect, or too great a degree of solidity of the small spongy bones of the upper jaw, the caverns of the forehead, &c. may likewise impair this sense; and it may be also injured by a collection of fetid matter in these caverns, which is continually exhaling from them, and also by immoderate use of snuff. When the nose abounds with moisture, after gentle evacuations, such things as tend to take off irritation, and coagulate the thin sharp serum, may be applied, as the oil of anise, mixed with fine flour, camphor dissolved in oil of almonds, &c. the vapours of amber, frankincense, gum-mastic, and benjamin, may likewise be received into the nose and mouth. For moistening the mucus when it is too dry, some recommend snuff made of the leaves of marjoram, mixed with oil of amber, marjoram, and aniseed; or a sternutatory of calcined white vitriol, twelve grains of which may be mixed with two ounces of marjoram water, and filtrated. The steam of vinegar upon hot iron, and received up the nostrils, is also of use for softening the mucus, removing obstructions, &c. If there be an ulcer in the nose, it ought to be dressed with some emollient ointment, to which, if the pain be very great, a little laudanum may be added. If it be a venereal ulcer, twelve grains of corrosive sublimate may be dissolved in a pint and a half of brandy, and a table-spoonful of it taken twice a-day. The ulcer ought likewise to be washed with it, and the fumes of cinnabar may be received up the nostrils.

If there be reason to suspect that the nerves, which supply the organs of smelling, are inert, or want stimulating, volatile salts, or strong snuffs, and other things, which occasion sneezing, may be applied to the nose; the forehead may likewise be anointed with balsam of Peru, to which may be added a little oil of amber. See **BRAIN**, **LIFE**, and **NERVOUS System**.

SMELNITZ, or **SZOMOLNOK**, in *Geography*, a town of Hungary; 14 miles S. of Kapisdorf.

SMELT, *Apua Phalerica*, or *Salmo Eperlanus* of Linnaeus, in *Ichthyology*, a fish which is classed, by the generality of writers, among the truttaceous kinds, and is ac-

knowledged to have a general external resemblance to the salmon. See SALMO *Eperlanus*.

It inhabits the seas of the northern parts of Europe, and, Mr. Pennant apprehends, is never found as far south as the Mediterranean.

These fish will live almost any where, but they are very apt to degenerate. They are common in the rivers of New England, and are as large as with us, often weighing two ounces and a half; but a pailful of these being taken from one of their rivers, and put into an adjoining pond, they all degenerated in such a manner, that they were afterwards found so small, that the largest did not weigh more than five pennyweights. Though thus small, however, they are much valued, and are better tasted than the others. Philos. Trans. N^o 374. p. 232.

They are called smelts, because they melt, as it were, or dissolve between the fingers in handling them; or, as others say, on account of their scent, *quasi smell it*. The name *sparling*, by which they are called in Wales and the north of England, is taken from the French *eperlan*: smelts are often sold in the streets of London split and dried, and called *dried sparlings*.

SMELT *Fishing*. See FISHING, *Smelt*.

SMELT, among the fishermen in Yorkshire, and some other parts of England, is also a name given to the salmon, while in its first year. See SALMON.

SMELTING, among *Metallists*, the melting of a metal from the ore in a smelting furnace; in order to separate the metallic parts from the sulphur and arsenic, and the earthy and strong substances of all kinds with which they are combined.

Smelting, in propriety, is restrained to large works, in which ores from the mines are melted down and separated.

In speaking of works in a lesser way, we do not say smelting, but *melting*.

In the more precious metals this is called *refining*; which see. And smelting is most commonly applied to the reduction of iron ores.

The art of smelting the ores of all metallic substances was, probably, at first very imperfect; hence the use of iron has every where been of a more recent date than that of the other metals, because it requires the application of a much stronger fire to smelt the ores of iron than those of any other metal. We have no certain accounts when, or by whom, the several metals were discovered. Wallerius says, that, as far as he knew, Pliny was the first who enumerated the six metals; but they were certainly known long before his age, and were mentioned both by Homer and by Moses, a much more ancient author. (Numb. xxxi. 22.) From this testimony we may certainly infer, that all the metals, anciently mentioned, were known, at least in the country of the Midianites, above fourteen hundred and fifty years before the birth of Christ, or near nine hundred years after the deluge. Moreover, iron and copper were, without doubt, known before the deluge, and probably all the other metals, which are more easily extracted from their ores than the former.

In the time of Abraham, however, gold and silver were esteemed, as they are at present, precious metals (Gen. xxiii. 16. Gen. xiii. 2.); and hence it is reasonable to conclude, that Noah was able to instruct his descendants in the art of smelting metallic ores; this art was afterwards lost among the various colonies, which quitted the plains of Asia in search of settlements; and as the earth, soon after the deluge, and long before it could have been peopled by the posterity of Noah, must have become cover-

ed with wood, and in process of time different countries might have been cleared by setting the wood on fire, which might flux metallic ores contiguous to the surface of the earth, it is not improbable, that the first idea of smelting ores might have been thus suggested to many nations. See Creech's Lucretius, vol. ii. p. 572.

We may hence conjecture, that the first rude process, by which metals were extracted from their ores, was that of putting a quantity of ore upon a heap of wood, and setting the pile on fire, in conformity to the manner, in which ores were smelted during the burning of forests; but as the force of the fire is greatly diminished by the dispersion of its flame, and as the air acts more forcibly in exciting fire, when it rushes upon it with greater velocity, it is likely that the heap of wood and ore would soon be surrounded with a wall of stone, in which sufficient openings would be left for the entrance of the air, and thus a kind of furnace would be constructed.

The Peruvians, we are told, had discovered the art of smelting and refining silver, either by the simple application of fire, or where the ore was more stubborn, and impregnated with foreign substances, by placing it in small ovens or furnaces on high grounds, so artificially constructed, that the draught of air performed the function of a bellows, a machine with which they were totally unacquainted. This method of smelting ores on high grounds, without the assistance of a bellows, or at least of bellows moved by water, seems to have been formerly practised in other countries as well as in Peru. There are several places in Derbyshire, called *boles* by the inhabitants, where lead has been anciently smelted, before the invention of moving bellows by water; these boles were always situated upon high grounds, and mostly upon that side of a hill which faces the west, probably because the wind proceeds most frequently from that quarter.

From a pig of lead, dug up in 1766 at one of these boles near Matlock, and bearing an inscription in relievo, from which it appears to have been smelted in the age of Adrian; many of the boles in Derbyshire seem to be of high antiquity. However, this method of smelting ore by the variable action of the wind, being a very troublesome and precarious process, has been universally disused, and the more regular blast of a bellows has been introduced in its stead.

The invention of the bellows is attributed by Strabo to Anacharsis, the Scythian; but he was probably the improver of this machine; for Homer, who lived long before his time, describes Vulcan as employing twenty pair of bellows at once in the formation of the shield of Achilles. Iliad, lib. xviii. v. 470.

When the art of moving bellows by means of a water-wheel was first discovered, is uncertain; the ancients seem to have been unacquainted with it; but we learn from Agricola (*De Re Metal.* published in 1550, pp. 165. 338.) that it was very generally known, at least among the Germans, in his time; for he speaks of it often, without hinting at its being a recent invention. By this advantageous contrivance, however, the moderns have, in many instances, worked over again, with considerable profit, the heaps of iron and other kinds of slag, from which the metal has been but imperfectly extracted, before the moving of the bellows by water was discovered.

About fifty years ago, the blast, or hearth-furnace, was the only one in use for smelting lead-ore in Derbyshire. In this furnace, ore and charcoal, or ore, and what is called *white coal*, which is wood dried but not charred, being placed, in alternate layers, upon a hearth properly constructed, the fire is raised by the blast of a bellows, moved

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by a water-wheel; the ore is soon smelted by the violence of the fire, and the lead, as it is produced, trickles down a proper channel, into a place contrived for its reception. These ore-hearths are now very rare; though they are frequently applied to the extracting lead from the slag which is produced, either at the ore-hearth, or the cupola furnace, and they are then called *slag-hearths*, and the lead thus obtained is called *slag-lead*; the fire in a slag-hearth is made of the cinder of pit-coal instead of charcoal; the furnace called a *cupol*, or *cupola*, and *reverberatory* furnace, and by the Germans a *wind-furnace*, in which ores are smelted by the flame of pit-coal, is said to have been invented about the year 1698, by a physician named Wright; though Becher may, perhaps, be thought to have a prior claim to its invention, or introduction from Germany. But whoever was the first inventor of the cupola, it is now in general use, not only in Derbyshire and other counties for the smelting of ores of lead, but both at home and abroad, where it is called the *English furnace*, for the smelting of copper ores. This furnace is so contrived, that the ore is melted, not by coming into immediate contact with the fuel, but by the reverberations of the flame upon it. The bottom of the furnace, on which the lead-ore is placed, is somewhat concave, shelving from the sides towards the middle; its roof is low and arched, resembling the roof of a baker's oven: the fire is placed at one end of the furnace, upon an iron grate, to the bottom of which the air has free access; at the other end, opposite to the fire-place, is a high perpendicular chimney; the direction of the flame, when all the apertures in the sides of the furnace are closed up, is necessarily determined, by the stream of air which enters at the grate, towards the chimney, and in tending thither it strikes upon the roof of the furnace, and being reverberated from thence upon the ore soon melts it. This furnace does not require the use of bellows, and may, therefore, be constructed any where. In smelting lead-ore, they generally put into the cupola furnace a ton of ore, previously beat small and dressed, at one time, which quantity they call a *charge*; and they work off three charges of ore in every twenty-four hours. In about six hours from the time of charging, the ore becomes as fluid as milk. In order to obtain the lead free from the slag which swims over it, the smelters usually throw in about a bushel of lime, which dries upon the slag, and prevents its running out with the lead. The slag, thus thickened, is raked up towards the sides of the furnace, and the lead gushes out through a hole in one of the sides of the furnace, which having been properly stopped during the smelting of the ore, is opened for this purpose into an iron pot, from which it is laded into iron moulds, containing what they call a pig of lead; the pigs, when cold, being ordinarily stamped with the maker's name, are sold under the name of *ore-lead*. After the lead has all flowed out of the furnace, they stop up the tap-hole, and drawing down the slag and lime into the middle of the furnace, they raise the fire, till the mixture of slag and lime, which they simply term *slag*, is rendered very liquid; upon this mass they throw another quantity of lime, and proceed as before. When the lead thus obtained, amounting generally to twenty or thirty pounds, is let out of the furnace, a new charge of ore is put in and the operation renewed.

In order to spare the time and expence of fuel, they have, in some furnaces, lately contrived a hole, through which they suffer the main part of the liquid slag to flow out, before they tap the furnace for the lead; upon the little remaining slag they throw a small portion of lime, and draw the mixture out of the furnace without smelting it. This kind of furnace they have nicknamed a *maccaroni*.

Dr. Watson has suggested some improvements in the construction of this furnace, and in the process of smelting above described. He proposes to substitute an horizontal chimney in the place of the perpendicular one now in use, and that the end farthest from the fire should be turned up by a tube of earthen-ware, or otherwise; so that the sulphureous acid, set at liberty during the burning of the sulphur, may issue out in a direction parallel to the flue of the chimney, and at the distance of about one foot and a half above it. Let a number of large globular vessels be made either of glass or lead, each of which must have two necks, so as to be capable of being inserted into one another: let these vessels be placed in the flue of the chimney, the neck of the first being inserted into the above-mentioned tube, and the neck of the last being left open, for fear of injuring the draught of the furnace. Let each of these globular vessels contain a small quantity of water, in which case, he apprehends, that the heat of the flue will raise the water into vapour, and that this watery vapour will be the means of condensing the sulphureous acid vapour, in such a degree as to render the undertaking profitable. When the sulphur is all consumed, the draught of the furnace may be suffered to have its ordinary exit at the end of the horizontal chimney, by a very slight contrivance of a moveable damper.

The same ingenious writer also observes, that very sulphureous ore should be roasted for a long time with a gentle heat. He also proposes to leave as little lead as possible in the slag; for this purpose he suggests, that it might be useful to throw a quantity of charcoal-dust upon the liquid scoria in the cupola furnace, in order that the calcined lead might be converted into lead, by uniting itself to the inflammable principle of the charcoal; and that it might be also useful to flux sulphureous lead-ores in conjunction with the scales or other refuse pieces of iron, or even with some sorts of iron-ore.

The smelter might farther find it worth his while to reduce the slag into a powder by a stamping mill, or to grind it by any other contrivance, and then he may separate the stony part of the slag from the metallic, by washing the whole in water, inasmuch as the metallic part is heavier than the other. Watson's Chem. Ess. vol. iii. p. 253, &c.

The other furnaces used in smelting are supplied with large bellows, moved by the arbor of a wheel, which is turned round by a current of water. These have obtained different names, according to some difference in their construction. Their greater or less height gives occasion also to the distinction of *high furnaces* and *middle furnaces*. The high furnaces are of modern invention; they were first introduced at Mansfeld in 1727, and are now used in almost all countries where ores are smelted, as in Saxony, Bohemia, Hungary, &c. They contribute, by their great height, being above eighteen feet high, which allows the ore to undergo a roasting by different degrees of heat before it is melted, to simplify and diminish the labour. They are chiefly employed for crude fusions, and particularly for the slate copper-ore.

In order to facilitate the extraction of metallic substances from the ores and minerals containing them, some operations, previous to the fusion or smelting of these ores and minerals, are generally necessary. These operations consist of, 1. The *separation* of the ores and metallic matter from the adhering unmetallic earths and stones, by hammers, and other mechanical instruments, or by washing with water. 2. Their *division* or reduction into smaller parts by contusion and trituration, that by another washing with water they may be more perfectly cleansed from extraneous matters, and rendered fitter for the subsequent operations. 3. *Roasting*,

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ing, or calcination, the uses of which operation are to expel the volatile, useless, or noxious substances, as water, vitriolic acid, sulphur, and arsenic; to render the ore more friable and fitter for the subsequent confusion and fusion; and, lastly, to calcine and destroy the viler metals; for instance, the iron copper-ores, by means of the fire, and of the sulphur and arsenic. Stones, as quartz and flints, containing metallic veins or particles, are frequently made red-hot, and then extinguished in cold water, that they may be rendered sufficiently friable and pulverable, to allow the separation of the metallic particles.

Roasting is unnecessary for native metals; for some of the richer gold and silver-ores; for some lead-ores, the sulphur of which may be separated during the fusion; and for many calciform ores, as these do not generally contain any sulphur and arsenic.

In the roasting of ores, the following attentions must be given: 1. To reduce the mineral previously into small lumps, that the surface may be increased; but they must not be so small, nor placed so compactly, as to prevent the passage of the air and flame. 2. The larger pieces must be placed at the bottom of the pile, where the greatest heat is. 3. The heat must be gradually applied, that the sulphur may not be melted, which would greatly retard its expulsion; and that the spars, fluors, and stones, intermixed with the ore, may not crack, fly, and be dispersed. 4. The ores not thoroughly roasted by one operation must be exposed to a second. 5. The fire may be increased towards the end, that the noxious matters more strongly adhering may be expelled. 6. Fuel which yields much flame, as wood and fossil coals free from sulphur, is said to be preferable to charcoal or coaks. Sometimes cold water is thrown on the calcined ore at the end of the operation, while the ore is yet hot, to render it more friable.

No general rule can be given concerning the duration or degree of the fire, these being very various according to the difference of the ores. A roasting during a few hours or days is sufficient for many ores; while some, such as the ore of Rammelsberg, require that it should be continued during several months.

Schlutter enumerates five methods of roasting ores. 1. By constructing a pile of ores and fuel placed in alternate strata, in the open air, without any furnace. 2. By confining such a pile within walls, but without a roof. 3. By placing the pile under a roof, without lateral walls. 4. By placing the pile in a furnace consisting of walls and a roof. 5. By roasting the ore in a reverberatory furnace, in which it must be continually stirred with an iron rod.

Several kinds of *fusions of ores* may be distinguished. 1. When a sulphureous ore is mixed with much earthy matter, from which it cannot be easily separated, by mechanical operations, it is frequently melted, in order to disengage it from these earthy matters, and to concentrate its metallic contents. By this fusion, some of the sulphur is dissipated, and the ore is reduced to a state intermediate betwixt that of ore and of metal. It is then called a *mat* (*lapis sulphureo-metallicus*), and is to be afterwards treated like a pure ore by the second kind of fusion, which is properly the smelting, or extraction of metal by fusion. 2. By this fusion or smelting, the metal is extracted from the ore previously prepared by the above operations, if these be necessary.

The ores of some very fusible metals, as of bismuth, may be smelted by applying a heat sufficient only to melt the metals, which are thereby separated from the adhering extraneous matters. This separation of metals by fusion, without the vitrification of extraneous matters, may be

called *eliquation*. Generally, a complete fusion of the ore and vitrification of the earthy matters are necessary for the perfect separation of the contained metals. By this method, metals are obtained from their ores, sometimes pure, and sometimes mixed with other metallic substances, from which they must be afterwards separated. To procure this separation of metals from ores, these must be so thinly liquefied, that the small metallic particles may disengage themselves from the scoria; but it must not be so thin as to allow the metal to precipitate before it be perfectly disengaged from any adhering extraneous matter, or to pervade and destroy the containing vessels and furnace. Some ores are sufficiently fusible; but others require certain additions, called *fluxes*, to promote their fusion, and the vitrification of their unmetallic parts; and also to render the scoria sufficiently thin to allow of the separation of the metallic particles.

Different fluxes are suitable to different ores, according to the quality of the ore, and of the matrix, or stone adherent to it.

The matrixes of two different ores of the same metal frequently serve as fluxes to each other; as, for instance, an argillaceous matrix with one that is calcareous; these two earths being disposed to vitrification when mixed, though each of them is singly infusible. For this reason, two or more different ores to be smelted are frequently mixed together.

The ores also of different metals require different fluxes. Thus, calcareous earth is found to be best suited to iron ores, and spars and scoria to fusible ores of copper.

The fluxes most frequently employed in the smelting of ores, are calcareous earth, fluors or vitreous spars, quartz, and sand, fusible stones, as slates, basaltes, the several kinds of scoria, and pyrites.

Calcareous earth is used to facilitate the fusion of ores of iron, and of some of the poorer ores of copper, and, in general, of ores mixed with argillaceous earths, or with spar. This earth has been sometimes added with a view of separating the sulphur, to which it very readily unites: but by this union, the sulphur is detained, and a hepar is formed, which readily dissolves iron and other metals, and so firmly adheres to them, that they cannot be separated without more difficulty than they could from the original ore. This addition is therefore not to be made till the sulphur be previously well expelled.

Fluors, or fusible spars, facilitate the fusion of most metallic minerals, and also of calcareous and argillaceous earths, of steatites, asbestos, and of some other infusible stones, but not of siliceous earths without a mixture of calcareous earth.

Quartz is sometimes added in the fusion of ferruginous copper ores, the use of which is said chiefly to be, to enable the ore to receive greater heat, and to give a more perfect vitrification to the ferruginous scoria.

The fusible stones, or slates, basaltes, are so tenacious and thick when fused, that they cannot be considered properly as fluxes, but as matters added to lessen the too great liquidity of some very fusible minerals.

The scoria obtained in the fusion of an ore is frequently useful to facilitate the fusion of an ore of the same metal, and sometimes even of the ores of other metals.

Sulphurated pyrites greatly promotes the fusibility of the scoria of metals, from the sulphur it contains. It is chiefly added to difficultly fusible copper ores, to form the sulphureous compounds called *matts*, that the ores thus brought into fusion, may be separated from the adhering earthy matters, and that the ferruginous matter contained in them may

be destroyed, during the subsequent calcination and fusion, by means of the sulphur.

As in the ores called *calciform*, the metallic matter exists in a calcined state; and as calcination reduces the metals of mineralised ores (excepting the perfect metals) to that state also; therefore all calciform and calcined ores require the addition of some *inflammable substance* to reduce them to a metallic state. In great works, the charcoal or other fuel used to maintain the fire, produces also this effect.

Metals are sometimes added in the fusion of ores of other more valuable metals, to absorb from these sulphur and arsenic. Thus, iron is added to sulphurated cupreous and silver ores. Metals are also added in the fusion of ores of other more valuable metals, to unite with and collect the small particles of these dispersed through much earthy matter, and thus to assist their precipitation. With these intentions, lead is frequently added to ores and minerals containing gold, silver, and copper.

Ores of metals are also sometimes added to assist the precipitation of more valuable metals. Thus, antimony is frequently added to assist the precipitation of gold intermixed with other metallic matters. Macquer's Chem. Dict. Eng. edit. art. *Smelting*, note m. See COPPER, GOLD, IRON, LEAD, SILVER, TIN, &c. See also Schlutter's Treatise on the Smelting of Ores, translated from the German into French by M. Hellot, and Chem. Dict. art. *Smelting*, Eng. ed. notes n, o, p, q.

The following simple method of smelting is practised by the natives of the province of Mekran in Persia; which, although it may, at times, leave a trifling portion of the earth mixed with the metal, is, from its ingenuity, worthy of notice. When a sufficient quantity of the ore is collected, it is placed upon a pile of wood, which is set on fire, and constantly replenished with fresh fuel, until the ore melts and falls to the bottom, when it is separated from the ashes, and found to be considerably clearer than when first taken from the mine. It is then placed in a pit, made of earthen tiles, so constructed as to admit a fire under it. The ore is again melted in this pit, and a considerable quantity of the dross and dirt removed, by skimming the surface. After this process, the metal is lifted out in a liquid state, poured into hollow cylinders of clay, and then sold.

SMELTING-HOUSE, a house where they run and melt the ore into lead: one of these will run a ton in ten or twelve hours; but a fodder is their usual day's work, that is, twenty-two hundred and an half weight.

SMELTZ, in *Geography*, a river of Prussian Lithuania, which runs into the Curish Haff, two miles S. of Memel.

SMENUS, in *Ancient Geography*, a river of the Peloponnesus, in Laconia. It had its source in mount Taigetis, and its mouth on the left of a very elevated promontory, upon which was a temple of Diana Dictymna, according to Pausanias.

SMERWICK, in *Geography*, a small town of the county of Kerry, Ireland, situated on a bay to which it gives name; 7 miles N.W. from Dingle, and 173 S.W. by W. from Dublin.

SMEW, in *Ornithology*, the English name of the common mergus, known among authors by the names of *albellus*, and *mergus cirratus*.

SMICH, in *Geography*, a river that runs into the Danube, 3 miles W. of Sigmaringen.

SMIDARY, a town of Bohemia, in the circle of Koniggratz; 3 miles N. of Biezow.

SMIHANJE, a town of Croatia; 40 miles E. of Bihacs.

SMILA, in *Ancient Geography*, a town of Greece, in

the country of Crofæa, on the confines of Thrace and Macedonia.

SMILACINA, in *Botany*, a name which, with all our respect for its excellent author, professor Desfontaines, we cannot admit, as being fabricated from another existing generic name, *Smilax*, and therefore contrary to sound Linnæan laws, and to right reason. The establishment indeed of the genus itself, which is separated from *Convallaria* merely on account of the deep divisions of the corolla, revives an old question, long ago set at rest, as we presume, by Linnæus. It would be more desirable to discover a character by which the Linnæan *Convallaria*, including the *Polygonatum* and *Smilacina* of other authors, could be clearly distinguished from one or two of its neighbours. See *CONVALLARIA*, the third section of which comprises the *Smilacina* of Desfontaines, Ann. du Mus. d'Hist. Nat. v. 9. 51. Pursh North Amer. v. 1. 232. The essential character is thus given by the author last cited.

Corolla inferior, in six deep spreading segments. Stamens diverging, inserted into the base of each segment. Berry globose, of three cells. Flowers terminal, panicled, or somewhat umbellate.

SMILAU, in *Geography*, a town of Bohemia, in the circle of Czastau; 5 miles N. of Polna.

SMILAX, in *Botany*, *σμιλαξ* of the Greeks, a name originally belonging to the Yew, *Taxus*; but likewise applied by Dioscorides, with different epithets, to some other plants of a climbing nature. One of these he terms *τραχηια*, *rough*, and as the name of *Smilax* remains with this, among modern botanists, De Theis supposes the word to originate from *σμιλον*, a *scraper*. We cannot presume to offer any conjecture respecting its etymology or meaning. The *σμιλαξ* of Dioscorides, simply fo denominated, is stigmatized by him as a most dangerous poison; while his *σμιλαξ τραχηια* is celebrated as an antidote, so powerful, that if given to a new-born infant, he can never be poisoned as long as he lives!—Linn. Gen. 524. Schreb. 692. Willd. Sp. Pl. v. 4. 773. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 5. 387. Sm. Prodr. Fl. Græc. Sibth. v. 2. 259. Pursh 249. Brown Prodr. Nov. Holl. v. 1. 293. Juss. 24. Lamareck Illustr. t. 817. Gærtn. t. 16. (Ripogonum; Forst. Gen. t. 25. Brown Prodr. Nov. Holl. v. 1. 293.)—Class and order, *Dioecia Hexandria*. Nat. Ord. *Sarmentacea*, Linn. *Asparagi*, Juss.

Gen. Ch. Male, *Cal.* Perianth widely bell-shaped, of six oblong leaves, approximated at the base, reflexed and spreading at the extremity. *Cor.* none, unless the calyx be taken for such, (which, from the analogy of *Asparagus*, *Convallaria*, &c. it surely ought to be.) *Stam.* Filaments six, simple; anthers oblong.

Female, *Cal.* as in the male, deciduous. *Cor.* none. *Pist.* Germen superior, ovate; styles three, minute; stigmas oblong, reflexed, downy. *Peric.* Berry globose, of three cells. *Seeds* solitary in each cell, globose, one or two of them generally abortive.

Ess. Ch. Male, Calyx of six leaves. Corolla none.

Female, Calyx of six leaves, inferior, deciduous. Corolla none. Styles three. Berry of three cells. Seeds one, two, or three.

Obs. Mr. Brown defines the calyx *permanens*; we find it, as Linnæus says, *deciduous*. *RIPOGONUM* (see that article) has the stamens and pistils in the same flower.

Of this ample genus, Linnæus in Sp. Pl. has only thirteen species; Willdenow has forty-one. To these, four North American ones are added by Pursh, and Mr. Brown has four from New Holland, exclusive of the second species of *Ripogonum*. They are all climbing perennial plants, with

with simple, alternate, ribbed, entire leaves, with or without tendrils; the stem mostly shrubby, smooth or prickly, round or angular; flowers generally umbellate. The following examples may suffice.

SECT. 1. *Stem prickly, angular.* Fourteen species in Willdenow.

S. aspera. Red-berried Rough Smilax. Linn. Sp. Pl. 1458. Willd. n. 1. Ait. n. 1. Sm. Fl. Græc. Sibth. t. 959, unpublished. Matth. Valgr. v. 2. 551. Ger. Em. 859. (*S. aspera, rutilo fructu*; Cluf. Hist. v. 1. 112.)—Stem angular, very prickly. Leaves oblong-heart-shaped, somewhat hastate, with seven or nine ribs, coriaceous, bordered with spinous teeth.—Native of hedges and thickets, throughout the south of Europe. Dr. Sibthorp found it abundantly in marshy and rough stony ground, in Greece and all the neighbouring islands, flowering late in autumn. The stems climb, by means of tendrils, like our Bryony, and hang in festoons from the tops of hedges. They are woody, perennial, branched, zig-zag, plentifully armed with strong, scattered, hooked prickles, as are likewise the *footstalks* and edges of the evergreen leaves. Flowers white, with a flesh-coloured tint extended to their stalks, in small umbellate tufts, disposed in terminal, zig-zag, smooth clusters. Berries of a dull scarlet red, the size of currants, umbilicated, with three seeds in each.—This is doubtless the *σμίλαξ τραχιὰ* of Dioscorides; the Lofty, or Woody, Bramble of the modern Greeks.

The figure in Plukenet's *Phytographia*, t. 110. f. 3, indicated as a variety, is hardly such, but exhibits nearly the usual form of the leaves; what has been generally taken for *S. aspera* being in fact the following species, whose leaves are always broader.

S. nigra. Black-berried Rough Smilax. Willd. n. 2. Prodr. Fl. Græc. n. 2313, unpublished. (*S. aspera* β; Linn. Sp. Pl. 1458. *S. aspera nigro fructu*; Cluf. Hist. v. 1. 113. *S. aspera lusitanica*; Ger. Em. 860.)—Stem angular, prickly. Leaves oblong-heart-shaped, seven-ribbed, coriaceous, smooth at the edges.—Native of hedges in Spain, Portugal, and the south of France. Dr. Sibthorp observed it about Prusa, in Bithynia. The stems are less prickly than in the former; the leaves broader, not at all dilated at the sides, nor contracted in the middle, so as to approach a hastate form; their edges very slightly, or not at all, prickly; and the berries are black.

S. excelsa. Tall Smilax. Linn. Sp. Pl. 1458. Willd. n. 5. Ait. n. 2. Prodr. Fl. Græc. n. 2314, unpublished. (*S. orientalis, farmentis aculeatis, excelsas arbores scandentibus, foliis non spinosis*; Tourn. Cor. 45. Buxb. Cent. 1. 18. t. 27.)—Stem angular, prickly. Leaves ovate, slightly heart-shaped, with five or seven ribs, and no marginal prickles.—Native of the country near Constantinople. Gathered by Dr. Sibthorp in woods at the village of Belgrad. Buxbaum says it is frequent in hedges about villages in Thrace, as well as in Pontus and Cappadocia, and that it is very useful for fences and shade. The flowers are yellowish-green; the berries red.

Whether *S. aspera*, Alpin. Egypt. 141, cited with doubt by Linnæus, be this plant, is not clear to us. Willdenow thinks it a distinct species, not yet described by systematic writers.

S. Sarsaparilla. Medicinal Smilax, or Sarsaparilla. Linn. Sp. 1459. Willd. n. 9. Ait. n. 4. Pursh n. 5. Woodv. Med. Bot. t. 194. (*S. peruviana, Salsaparilla*; Ger. Em. 859.)—Stem prickly, somewhat quadrangular. Leaves elliptical, pointed, abrupt, three-ribbed; without prickles; slightly glaucous beneath. Common flower-stalk longer than the footstalk.—Common in the hedges and swamps

of North America, flowering in June and July. Pursh. The stem is stout, a little zig-zag, roundish, with about four slight unequal angles, and a few scattered hooked prickles. Full-grown leaves nearly orbicular, two and a half inches broad, abrupt or contracted at each extremity, with a short terminal point; their surface finely reticulated with veins, and marked with three strong ribs, the lateral ribs described by Willdenow hardly deserving to be so denominated. Footstalks short, broad, channelled, each crowned with two tendrils, subsequently deciduous. Flowers yellowish-white, in axillary, solitary, stalked umbels. Berries red, according to Woodville, whose figure, the only one extant, has not been noticed, his work being never quoted by Mr. Aiton, though it surely ranks high as an useful medical book, and the plates, by Mr. Sowerby, are, as far as possible, original. It is much to be wished that what are merely done from dried specimens, or from other authors, had been every where so acknowledged, by which the authority of the publication would have been unimpeachable, and on a par with any whatever. For the history, and medical qualities, of the root, see Sarsaparilla.

S. melastomifolia. Rough-ribbed Smilax.—Stem with many angles, densely and minutely prickly; as well as the seven ribs of the ovate, pointed, slightly heart-shaped, rough-edged leaves.—Gathered by Mr. Menzies, in the Sandwich islands. A fine new species, whose branches are zig-zag, nearly round, with numerous angles, all copiously beset with minute, straight, rigid prickles. Leaves three inches long, and near one and a half broad, with five principal ribs, and a pair of slender, wavy marginal ones. These all bear underneath copious prickles, like those of the branches and footstalks, ranged in several rows on the larger ribs. The reticulated veins are also rough with prickles, so that the leaf altogether resembles that of some species of *Melastoma*. Umbels axillary, stalked, one or more from each leaf, accompanied by large concave, sheathing bracts.

SECT. 2. *Stem prickly, round.* Nine species in Willdenow.

S. australis. Strong-veined New Holland Smilax. Br. n. 1.—Stem round, with copious prickles. Leaves ovate-oblong, acute, five-ribbed, smooth, without prickles. Tendrils in pairs on the footstalks.—Gathered by Mr. Brown, near Port Jackson, New South Wales. We received from Kew garden, in 1798, a specimen in flower of what we presume to be this species. It is distinguished by the copious, strong, straight prickles, of its round, slightly striated, zig-zag branches. The leaves are rigid and coriaceous, smooth, with five ribs, and innumerable prominent reticulated veins; their base somewhat heart-shaped; the footstalks short, broad, channelled, bearing from the middle two long spiral tendrils. Flowers white, numerous, in axillary umbels, whose stalks rather exceed the footstalks.

S. China. Chinese Smilax, or China-root. Linn. Sp. Pl. 1459. Willd. n. 15. Ait. n. 5. Woodv. Med. Bot. t. 236. (*Sankira, vulgò Quaquara*; Smilax minus spinosa, fructu rubicundo, radice virtuosa, China dicta; Kæmpf. Amoen. 781. t. 782. Frutex convolvulaceus spinosus sinicus, &c.; Pluk. Amalth. 101. t. 408. f. 1. China vulgaris officinarum; Ger. Em. 1618.)—Stem roundish, with scattered prickles. Leaves roundish-ovate, acute at each end, with three principal ribs.—Native of China and Japan; said to have been cultivated by Miller, in 1759. The stem is strongly zig-zag. Leaves one and a half or two inches long, and nearly as broad, smooth, with three straight principal ribs, and two wavy, more slight, lateral ones. Footstalks bearing two, or more, long twisted tendrils. Flowers, according to Kæmpfer, greenish-yellow, in umbels,

on slender, solitary, axillary stalks, longer than the footstalks. *Berries* the size of black currants, scarlet, mealy, austere like a medlar, said to contain four, five, or six seeds, a greater number than usual in this genus. We strongly suspect that more than one species is confounded under the history of this species. The Linnæan Chinese specimens have more heart-shaped leaves than any of the figures exhibit, nor is their stem prickly. Very possibly, however, these do not belong to the officinal China-root.

This root was brought into Europe, towards the middle of the 16th century, with strong recommendations of its virtues, as a cure for the venereal disease, as well as for various chronic, cutaneous, or rheumatic disorders. These are neither confirmed by experience, nor rendered probable by the sensible qualities of the root itself, which is farinaceous and nearly insipid.

S. caduca. Deciduous Smilax. Linn. Sp. Pl. 1460. Willd. n. 22. Ait. n. 9. Pursh n. 12.—Stem round, with distant straight prickles; branches angular. Leaves ovate, pointed, five-ribbed. Common flower-stalks hardly longer than the footstalks. Tendrils capillary, much shorter than the leaves.—In dry fields, from Canada to Virginia, flowering in June. *Pursh*. The stem is rather stout, quite round when full-grown, but the branches are decidedly angular, and strongly zig-zag. Prickles distant, stout, tipped with black. Leaves broadly ovate, or slightly heart-shaped, smooth, green on both sides, very finely veined, their lateral ribs often obsolete. Tendrils very small and slender, from the middle of each footstalk. Flowers few, greenish, in solitary umbels.

S. spinulosa. Bristly Smilax.—Stem round, with crowded, capillary, curved prickles; branches somewhat angular. Leaves ovate-oblong, pointed, five-ribbed; glaucous beneath. Tendrils capillary.—Sent from Pennsylvania, by the late Rev. Dr. Muhlenberg, who thought it had been improperly confounded with *S. caduca*. The quantity of fine setaceous prickles, on the stem or branches, seems to be variable; but the more oblong leaves, opaque and glaucous beneath, are very different from the last. We cannot refer this to any of Mr. Pursh's species.

SECT. 3. *Stem without prickles, angular*. Seven species in Willdenow.

S. latifolia. Broad-leaved Smilax. Br. n. 4. Ait. n. 11.—“Stem angular, without prickles. Leaves ovate, five-ribbed, smooth; somewhat heart-shaped or obtuse at the base. Footstalks bearing the tendrils.”—Gathered by Mr. Brown in the tropical part of New Holland. Sent to Kew, in 1791, by Sir Joseph Banks. It is there treated as a greenhouse plant, but has not yet flowered.

S. herbacea. Herbaceous Smilax. Linn. Sp. Pl. 1460. Willd. n. 27. Ait. n. 12. Pursh n. 16. (*S. claviculata hederifolia* tota lævis, e terrâ Marianâ; Pluk. Phyt. t. 225. f. 3, marked 4.)—Stem herbaceous, angular, simple, erect. Leaves oval, seven-ribbed. Tendrils from the base of the long footstalks. Common flower-stalks very long, compressed.—In dry fields, on the edges of woods, from New York to Carolina, flowering in June and July. *Pursh*. The root is perennial. Stems annual, brownish-purple, smooth, with a pair of revolute tendrils to each leaf. Umbels globose, of numerous flowers, on axillary stalks, near six inches long. Berries dark purple, depressed.—Plukenet's figure, if rightly quoted, is a very bad one, the leaves being not sufficiently elliptical, and the footstalks much too short.

SECT. 14. *Stem without prickles, round*. Eleven species in Willdenow.

S. elliptica. Elliptical Smilax. Br. n. 3.—“Stem without prickles; branches round, striated. Leaves elliptic-
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ovate, somewhat pointed, five-ribbed, smooth; rather acute at the base. Footstalks bearing the tendrils.”—Gathered by Mr. Brown in the tropical part of New Holland.

S. glycyphylla. Sweet-leaved Smilax. Smith in White's Voyage, 230. t. 24. f. A, B. Br. n. 2.—Stem round, without prickles. Leaves ovate-oblong, acute, three-ribbed, smooth, somewhat revolute; glaucous beneath. Footstalks bearing the tendrils.—Sent from the neighbourhood of Port Jackson, New South Wales, among the first communications from thence. The leaves, having a very sweet taste, like liquorice-root, accompanied with some bitterness, were used by the first settlers in that country, to make a sort of tea, which was thought good for the scurvy. The stem is wiry, smooth, and slender. Leaves about two or three inches long, reticulated, coriaceous; broad and rounded at the base, on shortish curved footstalks. Flowers in axillary, stalked umbels.

S. Pseudo-china. Bastard Virginian China-root. Linn. Sp. Pl. 1461. Willd. n. 38. Ait. n. 15. Pursh n. 10, excluding Sloane's synonym. (*S. virginiana, spinis innocuis armata, latis canellæ foliis, radice arundinacæ crassâ et carnosâ*; Pluk. Phyt. t. 110. f. 5. *China spuria nodosa*; Bauh. Pin. 297. *Pseudo-china radix ex Virginia*; Clus. Exot. 83.)—Stem round, without prickles. Leaves ovate, pointed, five-ribbed. Tendrils from the base of the footstalks. Common flower-stalks longer than the leaves.—In sandy fields and dry woods, from New Jersey to Carolina, flowering in May and June. A shrub. The roots very large, searched after by hogs. *Pursh*. The stem is of a purplish-brown, very smooth. Branches long, slender, leafy, climbing by means of slender, not very long, tendrils, springing in pairs from the very base of the angular footstalks. Leaves two inches, or 2½, in length, an inch or more in breadth, slightly heart-shaped at the base, undulated or crisped, but hardly crenate, at the margin, reticulated with veins, which, as well as the ribs, are sometimes rough with minute prickles beneath. Flower-stalks axillary, umbellate, longer than the leaves.—The root of this species is said to have been brought from Virginia for the true China-root, of which we have spoken under the second section. They seem to agree in their farinaceous or starch-like substance, which, it seems, is common to the roots of various other plants of this genus. Sloane describes one under the name of *S. aspera, fructu nigro, radice nodosâ, magnâ, levi, farinacæ, China dictâ*; Sloane Jam. v. 1. 231. t. 143. f. 1. This, he says, has a root as thick as a man's leg, crooked and swelling, with a thin red-brown skin, and a friable light red internal substance, giving a reddish tincture to water. Its qualities are like the real China-root, in the place of which Sloane recommends its use, at least in the West Indies. Linnæus cites this synonym under his *S. Pseudo-china*, with which it has little connection; and he refers also to the *S. aspera, foliis trinerviis oblongis, petiolis biclaviculatis*, Browne's Jamaica, 359, a specimen of which is attached, in the Linnæan herbarium, to the real *S. Pseudo-china*. The leaves of this are elliptical. Common flower-stalks extremely short. Tendrils from the middle of each footstalk. Stem angular; said to be prickly in the lower part. By these latter characters this plant of Browne should belong to the first section; while Sloane's, described with a round and very prickly stem, must be referred to the second. Moreover, Browne's is described with slender branching roots, and we must presume that his *Smilax*, n. 1, is rather Sloane's plant, as Mr. Lunan, in his Hortus Jamaicensis, v. 1. 180, makes it. We do not choose to run the risk of determining these several species, without authentic specimens, more especially as Dr. Swartz has left them untouched. Two more of this tribe are represented in
A 2 Plumier's

Plumier's *Icones*, t. 82 and 84, which cannot be referred to any of the before-mentioned. The latter, indeed, is thus adopted by Willdenow.

S. macrophylla. Large-leaved Smilax. Willd. n. 39.—(China altera, non aculeata, foliis amplioribus; Plum. Ic. 73. t. 84.)—Stem round, without prickles.—Leaves ovate, obtuse, somewhat heart-shaped, seven-ribbed. Tendrils from the middle of the short footstalks.—Native of the West Indies. The leaves nearly agree in size and shape, as well as the footstalks, with *Passiflora alata*. The umbels are axillary, solitary, on stalks twice the length of the footstalks.

SMILAX, in *Gardening*, contains plants of the shrubby, climbing, evergreen kinds, of which the species cultivated are, the rough smilax (*S. aspera*); the tall smilax (*S. excelsa*); the medicinal smilax, or farfaparilla (*S. farfaparilla*); the bay-leaved smilax (*S. laurifolia*); the black bryony-leaved smilax (*S. tamnoides*); the herbaceous smilax (*S. herbacea*); the Chinese smilax (*S. china*); and the bastard Chinese smilax (*S. pseudo-china*.)

In the first sort there is a variety which has the leaves eared at the base.

Method of Culture.—The six first hardy sorts may be increased by slipping the roots, layers, and seed. In the first mode, the stalks arising from the roots should be slipped with roots to each in the autumn, and be planted out either in nursery-rows for a year or two, or, which is better, where they are to grow. In the layer method, the stalks should be laid down in the common manner in autumn, and when well rooted, in the autumn following be taken off and planted out as above. The seed should be obtained from abroad, and be sown in pots filled with fine mould in the spring, being plunged in a hot-bed to forward their coming up; when the plants have attained some growth they should be planted out and managed as the others.

The two last tender sorts may be increased by layers of the young shoots, and dividing the roots, which should be laid down, or planted out in the spring season, in order to have the culture of other woody greenhouse plants of the same nature. The layers will be ready to take off in the spring following.

The first sorts are proper for shady situations, borders, &c. and the latter afford variety in the greenhouse collections, among others of similar growths.

SMILE', in *Surgery*, a lancet.

SMINTHEAN, SMINTHEUS, *σμιθεύς*, in *Antiquity*, an epithet given to Apollo; from the Greek *σμιθῆ*, a rat. There are two different accounts of the origin of this appellation: the first is, that, in the city of Chrysa in Mysia, was a priest of Apollo, called *Crinis*, with whom that god being offended, sent a herd of rats to spoil all his lands; but *Crinis* appeasing the deity, he came in person to his assistance, took up his lodgings with *Crinis's* shepherd, told him who he was, and destroyed all the rats with his arrows; in memory of which *Crinis* built a temple to his deliverer, under the name of *Apollo Smintheus*.

Strabo (l. 13.) says, that in Chrysa was to be seen a statue of Apollo by the hand of Scopas, the celebrated statuary of Paros, with the figure of a rat near his feet; and Heraclides of Pontus asserts, that the rats about that temple were sacred.

Clemens Alexandrinus, in his exhortation to the Greeks, gives us a different story. The Cretans, says he, intending to send out a colony, consulted the oracle of Apollo as to the place: the answer was, that they should fix their colony where those born of the earth should oppose them. Upon their arrival in the Hellespont, the rats, in the night-time, gnawed asunder all the strings of their bows: this

they deemed an accomplishment of the oracle, and there built a city called *Smintha*.

SMINTO, SMINTHIUM, in *Ancient Geography*, a town of Asia Minor, in the Troade, or, as Strabo says, in the territory of Adramyttium. But its true name was *Chrysa*. (See SMINTHEAN.) M. d'Anville has placed Sminthium at a small distance S. of Tros, or Troy: according to Homer, this town was in an island. It gave name to a neighbouring mountain, called "Sminthium Nemus." Steph. Byz.

SMIRIS, in *Natural History*. See EMERY.

SMIRSITZ, in *Geography*, a town of Bohemia, in the circle of Konigingratz; 6 miles N.E. of Konigingratz. N. lat. 50° 14'. E. long. 15° 42'.

SMITH, ADAM, in *Biography*, a distinguished writer in moral and political philosophy, was born in the year 1723, at Kirkaldy, in Fifeshire, where his father held the comptroller-ship of the customs. He received his early education under the care of his mother, then a widow, at the school of Kirkaldy, where he was noticed for an extraordinary passion for reading. At the age of fourteen he was removed to the university of Glasgow, in which he spent three years, attending, among the other lectures, those of the celebrated professor Hutcheson. In 1740 he was sent as a pensioner to Balliol college, Oxford. Here he spent seven years, and it is thought that during this period he employed himself chiefly in acquiring an exact knowledge of the languages, ancient and modern, and in cultivating an English style, by the practice of translating works of high reputation into his own language. Upon quitting the university he abandoned all thoughts of entering into the English church, for which purpose he had been sent thither, and went to Edinburgh, and found a friend and patron in lord Kaimes. In 1751 he was elected professor of logic at Glasgow, from which he was removed, in the following year, to that of moral philosophy. He now felt that he was in a situation accommodated to his talents and disposition, and in later life he was accustomed to speak of his residence and employment at Glasgow as the most useful and happiest portion of his life. His lectures, both logical and moral, were extremely popular; and his manner of delivering them, if not graceful, was said to be highly impressive. In those on moral philosophy were contained the rudiments of his two most celebrated works as an author. Of these, the first is entitled "The Theory of Moral Sentiments," and appeared in the year 1759. The fundamental principle is sympathy, which the author makes the source of our feelings concerning the propriety or impropriety of actions, and their good or ill desert. To this work he afterwards subjoined "A Dissertation on the Origin of Languages." These works were extremely well received, and gave him a place among the best writers of the time. They also made him known to several eminent characters; and it was in consequence of the reputation thus acquired, that he was engaged to accompany the duke of Buccleugh in his travels. He of course resigned his office as professor, and in the beginning of the year 1764, he set out for the continent. He had now an opportunity of comparing the ideas which he had already formed respecting political economy, with those of the ablest men in foreign countries, and also with facts that presented themselves to his observation in the course of his travels. A long residence in France introduced him to the acquaintance of Turgot, Quesnai, Necker, D'Alembert, Helvetius, Marmontel, and others, to whose particular notice he was recommended by his countryman David Hume, with whom he had long been in habits of friendship. He returned to his own country in the autumn of 1766, and the following ten years he passed in retirement with his mother at the obscure town of Kirkaldy. Here he

was habitually employed in reading, the fruits of which were at length given to the world in his celebrated "Inquiry into the Nature and Causes of the Wealth of Nations." This work has long been a standard work, not only in our own country, but throughout Europe. It has been studied and referred to by all who pay attention to the important political topics on which it treats. After the publication of this "Inquiry," he spent a great part of two years in London, where his society was courted by persons of the highest rank in the philosophical and literary world. In the year 1778 he obtained, through the interest of the duke of Buccleugh, the lucrative place of a commissioner of the customs of Scotland, in consequence of which he removed to Edinburgh, which was thenceforth the place of his residence. His mother, who lived to a great age, spent her last days with him here. After the death of his friend, Mr. Hume, he published that philosopher's memoirs of his own life, with some additions, in which he expressed himself so favourably with regard to the character and opinions of the deceased, that it was readily inferred his own sentiments with respect to revealed religion could not be very different from those of his friend, which drew upon him an attack in an anonymous letter, since known to have been from the pen of the late Dr. Horne, afterwards bishop of Norwich. In 1787 he was appointed rector of the university of Glasgow, and in 1790 he died, at the age of sixty-seven. A few days before his death he caused all his papers to be burnt, except a few Essays, which have since been published.

Dr. Smith was a man of great simplicity of character, subject to absence of mind in society, and fitter for speculative than active life. He was much beloved by his friends, and possessed a calm and benignant disposition. Of the originality and comprehensiveness of his views, the extent, variety, and the correctness of his information, and the inexhaustible fertility of his invention, he has left lasting monuments behind him. To his private worth, the most certain of all testimonies may be found in that confidence, respect, and attachment, which followed him through all the various relations of life. When perfectly at ease, and when warmed with conversation, his gestures were animated and not ungraceful; and in the society of those whom he loved, his features were often brightened by a smile of inexpressible benignity.

SMITH, EDWARD, one of the minor English poets, born in 1668, near Tenbury, Worcestershire, was the son of Mr. Neale, a merchant, by the daughter of lord Lechmere. The connection of his parents was dubious, or at least unavowed; for after his father's death, being left to the care of Mr. Smith, who had married his paternal aunt, he assumed his guardian's name, by which he was ever afterwards known. He was indeed, when grown to mature years, acknowledged by his mother as her legitimate son, but he derived no advantage from this declaration. He was educated at Westminster school, under Dr. Busby, who is said to have formed a high opinion of his talents, and, in consequence of this opinion, to have detained him longer than the usual time under his tuition. From Westminster he was elected to Trinity college, Cambridge, but having at the same time an invitation from Christchurch college, Oxford, he preferred the latter, and became a student of that college. Here he distinguished himself by Latin verses, written on some public occasions; and a Latin ode, which he composed in 1691, on the death of Dr. Pococke, the learned Orientalist, obtained for him much celebrity for a poetical imagination. In 1705 he was expelled from his college, on account of his intemperance and licentious conduct. He had, however, previously to this, taken his degree of M.A. He now went to

London, where his wit and convivial powers caused him to be much cared for by persons of eminence, especially of the Whig party; though neither his manners, nor his external appearance, rendered him adapted to good society. In 1708 he published a "Poem to the Memory of Mr. John Phillips," which is said to be the only one of his miscellaneous pieces that merits notice. It has been much admired, because it partakes more of satire than elegy. In the following year he produced his tragedy of Phædra and Hippolitus, which was not very well received. Addison, however, wrote the prologue, and Prior the epilogue; the principal actors took parts in it, and it was patronised by men of high rank, yet it was scarcely heard to the third night. "It has," says the critic, "more poetical than dramatic merit, and is greatly inferior, in point of delicacy, pathos, and conduct, to Racine's tragedy on the same subject." Mr. Smith died in the forty-second year of his age, and his early death was imputed, probably with great justice, to his intemperate habits. He had attained much harmony of versification as a poet, and possessed a certain luxuriance of fancy, but he gives no indication of a higher genius; and did very little for the interests of literature. He was lifted to temporary fame by the efforts of academic partiality, but has now sunk to the level of many who are well nigh forgotten. Johnson's Lives of the Poets.

SMITH, Sir THOMAS, an eminent scholar and statesman of the 15th century, was born at Saffron-Walden, in Essex, in 1524. He was educated for, and sent early to, Queen's college, Cambridge, and by his proficiency in learning obtained a pension as king's scholar. Being chosen fellow of his college, he was appointed, in 1535, to read the public Greek lecture, on which occasion he concurred with Cheke in introducing an improved mode of pronouncing that language. In 1539 he travelled to the continent, for the superior advantages offered by the foreign universities, and at Padua he studied the civil law, in which faculty he graduated. On his return he resumed his residence at Cambridge, where, in 1542, he was admitted to the degree of doctor, and was nominated king's professor in civil law. He pursued with great ardour his scheme of reforming the pronunciation of the Greek, and he likewise attended to the improvement of his native tongue, and published a work concerning its correct orthography and pronunciation. He was a promoter of the principles of the reformation in religion, and did his utmost to shelter those reformers who were exposed to the persecution of the tyrant Henry VIII. He had himself taken orders, possessed a rectory, and also the deanery of Carlisle. On the accession of the virtuous Edward VI., he was taken into favour by the protector Somerset, and raised to several lucrative posts, and in 1548 he was knighted, and appointed secretary of state. On the disgrace of the protector he was deprived of the secretaryship, but was soon replaced in it, and continued during the remainder of the reign in trust and honour. When Mary succeeded to the throne he lost all his offices, and was forbidden to quit the kingdom; but by his caution and prudence he was enabled to flee in safety through the stormy and perilous period. As soon as Elizabeth became queen he was invited to court, and reinstated in the deanery of Carlisle, and employed in various public concerns, particularly in the revision of the Liturgy. He was sent on various embassies to the court of France, and during one of his residences in that country he composed his work "On the Commonwealth of England." Owing to some disappointment he retired to the country, where he spent three years, exercising the duties of a magistrate, and distinguishing himself by his severity against supposed witches. In 1571 he returned to

court, was nominated a privy counsellor, and made assistant to lord Burghley, in his office of secretary of state. In 1572 he was employed to negotiate an alliance with France, and after his return he succeeded lord Burghley, who was advanced to the post of treasurer. He died in 1577, at the age of 63. Sir Thomas Smith is characterised by his eulogist, as "a master of various languages, ancient and modern, and as extremely well versed in several sciences. He was pious, upright, and benevolent, and seems to have been perfectly free from the duplicity and craft which were too frequent in the statesmen of that age." He is chiefly known as a writer by the "Commonwealth of England," already referred to. Several of his letters have been printed in different collections, and four of his orations, on queen Elizabeth's projected marriage, are annexed to his Life by Strype. *Biog. Brit.*

SMITH, THOMAS, a learned writer, was born at London in 1638. He was admitted of Queen's college, Oxford, in 1657, and after taking his degree in arts, was chosen, in 1663, master of the free-school adjoining to Magdalen college. He became fellow of that college in 1666, and was distinguished for his great knowledge in the Oriental languages. He accompanied the English ambassador to Constantinople in 1668, and afterwards lived several years as chaplain with sir Joseph Williamson, secretary of state. He quitted him without any preferment, and was earnestly solicited by several eminent clergymen, his particular friends, who knew his value, to return to the Levant, in order to collect MSS.; but knowing the danger attending such a business, he put a negative on their proposal. He had already made himself known to the learned world by a Latin dissertation on the Chaldee paraphrases, and their versions, another on the Druids, and several sermons on doctrinal points. He had also published some Latin epistles concerning the manners and institutions of the Turks, and the seven churches of Asia; of which he afterwards printed an English translation; and in 1680 he published an account of the Greek church. To these works, relative to what he had observed in the East, may be added some papers communicated by him to the Philosophical Transactions, and others contained in a collection of tracts, entitled "Miscellanea." In 1683 he took his degree of D.D., and was presented to a college-living, which he soon resigned, and continued to reside on his fellowship. When James II., in 1687, sent a mandate to Magdalen college for the admission of a popish fellow, Dr. Smith was one of the few persons who petitioned against the measure, but he was far from steady in his opposition; and when the king signified his determination to be obeyed, Dr. Smith was one of the two fellows who submitted, and in consequence preserved their fellowships, while the others had the honour of being expelled. The doctor, however, did not go far enough to please his sovereign, and was eventually expelled from his office. The succeeding troubles produced his restoration: but in 1692, refusing to take the oaths required by the government of William and Mary, he lost his fellowship and living with which he had been presented. He thenceforth resided chiefly in the family of sir John Cotton, occupied in his studies, and in the composition of a variety of works. Of these, the greater part was of the antiquarian and biographical class. In the latter, his principal publication was entitled "Vitæ quorundam eruditissimorum et illustrium Virorum," containing the lives of archbishop Usher and several other eminent characters. Dr. Smith died in 1710: he is characterised by his biographer as a man of great industry and learning, but he displayed in his writings much party bigotry and illibe-

rality. His Latin style is neither clear nor simple. *Biog. Brit.*

SMITH, CHARLOTTE, daughter of Nicholas Turner, esq. a gentleman of considerable property in the counties of Surry and Suffex, when very young married Mr. Smith, the son of a West India merchant. This match was not the effect of attachment on either side, and was productive of much misery, of which a long account is given in the Monthly Magazine, vol. xxiii. p. 244. The affairs of Mr. Smith not proving prosperous, she, after various persecutions from creditors, and after passing some time in the gloom of a prison with her husband, retired to a convent in Normandy. Here she was reduced to the utmost indigence, yet the exertion of her talents administered to her wants. She wrote several novels, which gained her a comfortable subsistence. She died, after various changes and misfortunes of life, at Thetford, near Farnham, Surry, in the year 1806. Her principal novels are as follow: "The Romance of Real Life;" "Emmeline;" "Ethelinda;" "Celestina;" "Desmond;" and "The Old Manor House." They display great powers of invention; and it is remarkable, that in them all she has contrived to interweave much of her own personal history, and painted in very strong colours the characters of certain rapacious persons, to whose dishonesty she ascribed all, or at least the greater part, of her sorrows. Mrs. Smith was also author of poems, sonnets, and two small volumes, entitled "Conversations introducing Poetry, chiefly on Subjects of Natural History, for the Use of young Persons." Her descriptions are interesting, and her style is elegant. Her sonnets possess great beauty, and all her writings every where display the powers of a fine imagination, correct taste, and strong judgment.

SMITH, GEORGE, a native of Chichester, born in 1714, was, in despite of circumstances in every respect unfavourable, a devotee to the art of painting, particularly in landscape; and by dint of determined perseverance succeeded in producing some works which do honour to his name. He was among the first who rescued the English name, in art, from the odium cast upon it by foreigners, and prepared the way for the brilliant efforts of Wilson. His idea of composition may be eliminated from the print, which Woollett engraved after the picture for which the Society in the Adelphi gave him their highest premium, and which presents a conception almost worthy of Claude: his colouring, indeed, did not keep pace with the design, and his touch was too minute and trifling. There are many prints of his other productions, some etched by himself, but the one we have mentioned is the finest. He died in 1766.

SMITH, ROBERT, LL.D. and D.D., was a contemporary to Barrow. After all our researches, we have not been able to collect any particulars relating to the place of his birth, which was probably in Lincolnshire, and the progress of his early years. It appears, however, that he was admitted A.B. in 1711, A.M. in 1715, LL.D. in 1723, and S.T.P. by royal mandate in 1739. He was first fellow, afterwards professor of astronomy and experimental philosophy, of which he was made Plumean professor in 1716, supplying the place of his cousin, the celebrated Cotes; and he succeeded Dr. Bentley, in 1742, in the mastership of Trinity college, in the university of Cambridge. He had been preceptor to William, duke of Cumberland, and was master of mechanics to the king. In the year 1722 he published, at Cambridge, Cotes's "Harmonia Mensurarum," with additions, in 4to.: in 1738 appeared his "Complete System of Optics, in four books, viz. a popular, a mathematical, a mechanical, and a philosophical treatise," &c. 2 vols.

4to.: in 1747 he published at Cambridge, in 8vo., a second edition of Cotes's "Hydrostatical and Pneumatical Lectures:" and in December 1748, he published his "Harmonics," of which a second edition, much augmented and improved, appeared in October 1758. The inscription over him is H. S. E. Robertus Smith, S. T. P. Hujus Collegii Magister, obiit Aug. 1768, ætatis 79.

Dr. Smith left two annual prizes of 2*l.* to two commencing bachelors of arts, who were to be the best proficient in mathematics and natural philosophy of the year. He also left 2000*l.* towards repairs of Trinity college, and 2500*l.* to the university.

Dr. Smith was a performer on the violoncello, and a curious inquirer into the defects of the musical scale on keyed instruments; which he tried to remedy by many ingenious experiments and calculations. He had a harpsichord made by Kirkman, with quarter-tones, as they are called, with only a single string to each note, by which means the instrument, not being crowded with two or three strings to each, by pedals could make any key perfect, as it allowed of two strings for each of the five short keys, differently tuned, to each note; as F♯ and G♭, G♯ and A♭, A♯ and B♭, &c. which rendered those keys delightful, and which, in the old tuning, were insufferable. But this perfect harmony only suited regular and sober modulation: the compositions of Haydn and Mozart, and their imitators, would want a new scale every two or three bars. Poor Claggett pursued this plan, and by means of multiplied strings and pedals had acquired perfect intonation to all the twenty-four keys. But by additional bridges, and the pressure of so many strings on the belly of the instrument, the tone was injured and enfeebled. This, alas! but confirms the two melancholy reflections, which tell us that "we cannot have every thing;" and that, "il faut souffrir dans ce monde."

The great mathematician, Dr. Smith, had so accustomed himself to perfect harmony, that he neither could bear the throwing of the imperfections of the scale on the *wolf*, or E♭, nor even on two or three short keys seldom used in old church music; but all the compound stops in the organ, such as the sesquialter and cornet, and the single stops of the twelve and the tierce in the chorus, he took out of the fine organ of Trinity college, Cambridge, built by father Smith, and reduced the whole chorus to unisons and octaves, which was thought by many to injure the instrument so much as to bereave it of all its spirit, and render it insipid. And after the decease of Dr. Smith we have been assured, that the excommunicated pipes have been again received into the bosom of the church.

Dr. Smith's "Harmonics," already mentioned, was professedly written to assist organ-builders and tuners to divide the redundancies of the scale equally, or nearly equally, among all the twelve semitones in the octave by a table of *beats*. To give the reader an idea of Dr. Smith's plan, we must refer him to the article BEATS, where this effect, produced by two organ-pipes nearly in tune, is explained. But Dr. Smith's treatise, so far from being intelligible to tuners of organs, and organ-players in general, requires a knowledge in geometry and fluxions, which none but great mathematicians able to read Newton's Principia possess. Yet the book is written in so pleasing and alluring a style, that many peruse as much as they are able of the unscientific part, and give the author credit for the accuracy of his calculations.

SMITH, JOHN CHRISTOPHER, a good musician, and a respectable man. He was the eldest son of the worthy John Christopher Schmidt, Handel's copyist, steward, and confidential countryman, who came over with him from

Germany, and lived an inmate with him to nearly the time of his death. He used to engage and pay the performers in the oratorios carried on by Handel himself; and being a good musician, was the most correct copyist of his time.

His son, John Christian, was a studious and cultivated man, and much esteemed by many of the first people in the kingdom. He was particularly regarded by the late lord Barrington, and all that noble family; and having early in life travelled with a gentleman of fortune, at Geneva he became acquainted with some English gentlemen of learning and talents, among whom were Mr. Price, of Foxley, Herefordshire; Mr. Windham, of Felbrig, Norfolk; Mr. Tate, of Mitcham, Surry; and Mr. Benjamin Stillingfleet, &c. This gave him a taste for, and procured him admission into, good company; so that he formed his character on models of a higher class than that of a mere musician.

In the Monthly Review of a pamphlet published in 1780, entitled "Anecdotes of George Frederick Handel, and of John Christian Smith," there are some passages relating to the venerable Mr. Smith, which we shall transcribe, being certain that they are accurate, from our own knowledge.

"After the period of Mr. Smith's return to England, he mixed very little with his professional brethren, though he continued to compose music, and to teach the harpsichord, till the year 1760; when, being in possession, not only of the *scores* of Handel's oratorios, but of the single vocal and instrumental parts, which had been transcribed for, and used by his numerous bands, Mr. Smith undertook to continue the performance of oratorios in Lent, during eight years, on his own account; and during nine more, jointly with Stanley.

"We have heard, from the first contemporary authority, that there was a shyness between Handel and the younger Smith for several years, which kept them asunder till the great musician lost his sight; but the difference was occasioned by no dignified cause of quarrel. Mr. Smith, early in life, having had some instructions from Handel, though his principal masters were Dr. Pepusch and Roseingrave, when about the year 1739, he published a book of harpsichord lessons, in 4to. Handel took it amiss that his scholar, the son of his copyist, should presume to have a title-page to his lessons engraved exactly in the same form and text-hand with his own first book of "Pieces de Clavecin," the best of all his productions. Mr. Smith's pieces were then perhaps inferior only to those of his model. They consisted, as was then the general fashion, of preludes, fugues, allemandes, corants, and jigs.

"Mr. Smith was certainly an elegant musician, and in his conduct and manners far above the general level of the professors of his art; but we are not certain, that his execution as a practitioner was great, nor that his invention as a composer was original. It is plain, that Mr. Smith's style of composition was that of the day, without an attempt at deviation; a style, which Handel had rendered *à-la-mode*, and to which not only Mr. Smith, but all the English composers, strictly adhered during more than forty years; as is manifest in the works of Green, Boyce, Arne, (in his oratorios,) Worgan, and Stanley. Arne, in his dramatic music, adopted easy and elegant passages from Italian operas; but we must except his *Comus*, in which there is much original melody, as well as in his Vauxhall ballads. Mr. Smith never was a popular composer. His oratorios, though new, and in support of which he had the patronage of several illustrious friends and great families, (particularly that of Barrington,) were not heard and attended so well as those of Handel, which had been in constant use for many years. The Eng-

lish opera of "The Fairies," in which Guadagni and Frafi performed the principal parts, had a considerable run; but it was never revived; nor did the airs penetrate into Vauxhall, Ranelagh, Mary-le-bone, private concerts, or private families, like those of Arne's Comus, or Boyce's Chaplet, after having been heard at the theatres.

SMITH, *Father*, or, as the Germans write his name, *Schmidt*, brought over with him from Germany, of which country he was a native, two nephews, Gerard and Bernard, as assistants; and to distinguish him from these, as well as to express the reverence due to his abilities, which placed him at the head of his profession, he was called *Father Smith*. During the grand rebellion, most of the organs in the kingdom having been destroyed, or stolen out of the churches, at the restoration a sufficient number of workmen for the immediate supply of cathedrals and parish churches, with organs, not being found in our own country, it was thought expedient to invite foreign builders of known abilities to settle among us; and the premiums offered on this occasion brought over the subject of our article and Harris.

The first organ which Smith engaged to build for this country was for the royal chapel at Whitehall, which, being hastily put together, did not quite fulfil the expectations of those who were able to judge of its excellence. An organ is so operose, complicated, and comprehensive a piece of mechanism, that to render it complete in tone, touch, variety, and power, exclusive of the external beauty and majesty of its form and appearance, is perhaps one of the greatest efforts of human ingenuity and contrivance. It was probably from some such early failure, that this admirable workman determined never to engage to build an organ upon short notice, nor for such a price as would oblige him to deliver it in a state of less perfection than he wished. And we have been assured by Snetzler, and by the immediate descendants of those who have conversed with father Smith, and seen him work, that he was so particularly careful in the choice of his wood, as never to use any that had the least knot or flaw in it; and so tender of his reputation, as never to waste his time in trying to mend a bad pipe, either of wood or metal; so that when he came to voice a pipe, if it had any radical defect, he instantly threw it away, and made another. This, in a great measure, accounts for the equality and sweetness of his stops, as well as the soundness of his pipes, to this day.

Smith had not been many months here, before Harris arrived from France, with his son René Rénatus, an ingenious and active young man, to whom he had confided all the secrets of his art. However, they met with but little encouragement at first, as Dallans and Smith had the chief business of the kingdom; but upon the decease of Dallans, who died while he was building an organ for the old church at Greenwich, 1672, and of the elder Harris, who did not long survive him, the younger became a very formidable rival to Smith.

For the contention between these eminent artists, at the time of erecting the admirable organ which still stands in the Temple church, see Burney's *Hist. of Music*, vol. iii. p. 437.

SMITH, THEODORE, a modern and pleasing composer of natural and easy music. He was a native of Germany, and published at Berlin, at 1780, three different sets of sonatas à quatre main, three in each set; and in 1782, six concertos for the harpsichord. Though a native of Germany, he resided so long in England as to be sufficiently acquainted with our language to publish, besides various musical compositions, a *Musical Directory*, printed by Welcker in 1778, an elementary work of considerable merit for its ar-

range and clear explanation of the first rudiments of a player on keyed-instruments.

SMITH, in *Geography*, a county of America, in the district of West Tennessee, containing 11,649 inhabitants.—Also, a township of Pennsylvania, in the county of Washington, containing 1646 inhabitants.

SMITH'S *Inlet*, a bay on the west coast of North America, the entrance of which is nearly closed by rocky isles. From the entrance into the inlet, whose north point lies from its south point N. 20 E. about a league distant, it was found to extend nearly in an east direction about six leagues; here it takes a turn to the N.E., and terminates in N. lat. 51° 24'. E. long. 232° 47½'. About three leagues within the entrance, the rocks and isles terminated, and the inlet contracted to a general breadth of about half a mile, though in some places it was near twice that distance from shore to shore; both of which were formed by high rocky precipices covered with wood. About half way up the canal a village of the natives was discovered, supposed to contain 200 or 240 persons. This was built upon a detached rock, connected with the main by a platform, and constructed for defence. A great number of its inhabitants, in about thirty canoes, visited captain Vancouver's party, and allured them in various ways to visit their habitations. They offered the skins of the sea-otter, and other animals, to barter; and besides promises of refreshment, made signs, not easily misunderstood, that the female part of their society would take pleasure in their company. The entrance is in N. lat. 51° 20'. E. long. 232° 12'.

SMITH'S *Island*, a small island near the east coast of Antigua.—Also, a small island in the Atlantic, near the coast of Virginia; part of a cluster collectively called "Smith's Islands." N. lat. 37° 15'. W. long. 75° 52'.—Also, a large and lofty island in the South Pacific ocean, discovered by lieutenant Ball, commander of the *Supply*, in 1790. S. lat. 9° 44'. E. long. 161° 54'.

SMITH'S *Point*, a cape on the coast of Virginia, forming the southern limit of the Potomack river. N. lat. 37° 54'.

SMITH'S *River*. See STAUNTON.

SMITH'S *Sound*, a bay on the east coast of Newfoundland, bounded by Cape Bonavista.

SMITHERY, a smith's shop; also the art of a smith, by which iron is wrought into any shape by means of fire, hammering, filing, &c.

SMITHFIELD, in *Geography*, a small post-town of Virginia, on Pagan creek, which discharges itself into James river, in the Isle of Wight county; 85 miles S.E. of Richmond. The creek is navigable for vessels of 20 tons.—Also, a post-town, and the capital of Johnson county, in North Carolina, on the east side of Neus river, on a beautiful plain, about 100 miles N.W. of Newburn. In the centre of the town is an Indian burying-place, once in the form of a cone, 16 feet high, 30 feet in diameter, but its height is now reduced to five or six feet.—Also, a town of Jefferson county, in the state of Ohio, containing 1228 inhabitants.—Also, a township of New York, in Madison county, bounded north by Lenox, east by Augusta in Oneida county, south by Eaton and Nelson, and west by Cazenovia; erected in 1807 from Cazenovia, and about 12 miles east and west, and 5 north and south. The principal part of this tract was leased of the Oneida Indians by Peter Smith, 1794, and purchased by the state in 1795. The soil is of a superior quality, and the whole tract is one of the best in the state. It is amply irrigated by small streams, and also by the main branch of the Chenango river, itself a branch of the Susquehanna. This town is principally settled by emigrants from the eastern states, and comprises

comprises the largest part of the tract called New Peterburg. The population in 1810 consisted of 2651 persons. The principal village is Peterboro', situated on the Oneida creek. N. lat. $42^{\circ} 57'$, and W. long. $1^{\circ} 37'$ from New York. —Also, a township of Pennsylvania, in Lycoming county, containing 1084 inhabitants.—Also, a town of Rhode island, in Providence county, containing 3828 inhabitants.

SMITHFIELD, *Lower*, a township of Pennsylvania, in the county of Northampton, containing 1326 inhabitants.

SMITHFIELD, *Upper*, a township of Pennsylvania, in the county of Wayne, containing 520 inhabitants.

SMITHFIELD, *Middle*, a township of Pennsylvania, in the county of Wayne, containing 682 inhabitants.

SMITHIA, in *Botany*, was so named, after the writer of the present article, in the first edition of the *Hortus Kewensis*, of his ever valued and lamented friend the late Mr. William Aiton, published in 1789.—Ait. Hort. Kew. ed. 1. v. 3. 496 and 512. ed. 2. v. 4. 336. Schreb. 809. Willd. Sp. Pl. v. 3. 1161. Mart. Mill. Dict. v. 4. Lamarck Dict. v. 7. 222. Illustr. t. 627.—Class and order, *Diadelphia Decandria*. Nat. Ord. *Papilionaceæ*, Linn. *Leguminosæ*, Juss.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, two-lipped; the segments ovato-lanceolate, concave, acute, nearly equal. *Cor.* papilionaceous. Standard inversely heart-shaped. Wings oblong, obtuse, rather shorter than the standard. Keel linear-oblong, of one petal, cloven at the base, the length of the wings. *Stam.* Filaments ten, united into two equal sets, combined at the bottom; anthers oblong. *Pist.* Germen superior, embraced by the base of the calyx; style capillary, permanent; stigma simple. *Peric.* Legume included within the calyx, of from four to seven orbicular, single-seeded, distinct, mucicated joints, connected with the permanent folded style, and lying horizontally over each other. *Seeds* solitary, kidney-shaped, compressed, smooth.

Ess. Ch. Stamens in two equal sets. Legume of several horizontal, separate joints, connected by the folded style, and inclosed in the two-lipped, equal calyx.

This genus, though established under the authority of two very eminent botanists, Mr. Dryander and Mr. Salisbury, who thought it peculiarly well marked, has of late been found so nearly to accord with the original species of *Aeschynomene*, as to be scarcely distinguishable therefrom. Mr. Brown, however, who made this discovery, still considers *Smithia* as distinct; the legume of *Aeschynomene* being straight, composed of a series of vertical joints, connected by their edges, and projecting out of the calyx, while the latter is deeply divided. Their habits, and even the sensibility of their foliage, bring them so closely together, that we doubt, at least, the propriety of keeping them separate, though we are content, for the present, to leave them as we find them. Two species only of the genus before us have been observed.

1. *S. sensitiva*. Annual *Smithia*. Ait. Hort. Kew. ed. 1. v. 3. 496. t. 13. ed. 2. n. 1. Willd. n. 1. Salisb. Parad. t. 92.—“Lips of the calyx entire. Clusters stalked, of few flowers.”—Discovered in moist pastures, on the coast of Coromandel, by J. G. Koenig, M.D., by whom seeds were sent in 1785 to Sir Joseph Banks. The plant is annual, and usually kept in a hot-bed, or stove; but, according to Mr. Salisbury, the seeds scattering themselves in favourable situations, will sometimes come up in the open ground, even in dry gravel. The root is tapering. Stems several, spreading, various in luxuriance, more or less branched, round, smooth, leafy. Leaves alternate, abruptly pinnate, of four, five, or six pair of elliptical, obtuse,

entire leaflets, about a quarter of an inch long; oblique at the base; glaucous beneath, their mid-rib and margins especially beset with long, bristly, tawny, close-pressed hairs. *Stipulas* in pairs, lanceolate, membranous, ribbed; auricled and spurred at the base. The leaves fold together when touched, as in the *Mimosa pudica*, but more tardily, unless in a very hot atmosphere. The flowers are yellow, rather small, with a purplish calyx, accompanied by a pair of close bracteas, half its own length. Joints of the legume as small as Red-poppy seed.

2. *S. conferta*. Close-flowered *Smithia*.—Lips of the calyx toothed. Clusters sessile, shorter than the leaves.—Gathered in the tropical part of New Holland, by Sir Joseph Banks, to whom we are obliged for a specimen. This seems likewise to be an annual herbaceous plant. The stems are erect, slender, unbranched, round, smooth. Leaves few, distant, except at the top, where two or three are crowded together; their leaflets much as in the foregoing. *Stipulas* spurred, but scarcely auricled. Clusters axillary, sessile, of a very few flowers, whose petals, in the dried specimen, are of a reddish or tawny hue. By the position of the dried leaves this species seems also sensitive; and perhaps they fold at night over the flowers, like those of the *Lotus tetragonolobus*, celebrated for having first led Linnæus to consider what he afterwards called the Sleep of Plants.

SMITHLAND, in *Geography*, a post-town of Kentucky, in the county of Livingston, containing 99 inhabitants: the county contains 3575.

SMITHTOWN, a post-township of New York, in Suffolk county, Long Island; 92 miles E. of New York; containing 1592 inhabitants, including 72 slaves. This place employs 14 vessels principally in the trade with New York, of 30 to 100 tons burthen.

SMITHVILLE, a town of North Carolina, near the mouth of Cape Fear river; 30 miles S. of Wilmington.—Also, a township of Chenango county, erected from a part of Greene in 1808; 13 miles S.W. of Norwich; containing 995 inhabitants, who manufacture most of their clothing in the household way.

SMITING-LINE, in a *Ship*, is a small rope fastened to the mizen-yard-arm, below at the deck, and is always furled up with the mizen-sail, even to the upper end of the yard, and from thence it comes down to the poop. Its use is to loose the mizen-sail, without striking down the yard, which is easily done, because the mizen-sail is furled up only with rope-yarns; and, therefore, when this rope is pulled hard, it breaks all the rope-yarns, and so the sail falls down of itself. The word of art is, *smite the mizen*, (whence this rope takes its name,) that is, hale by this rope that the sail may fall down.

SMITTL, in *Geography*, a town of Asiatic Turkey, in Caramania; 18 miles E.N.E. of Cogni.

SMOCK, LADY'S, or *Bitter Cresses*, in *Agriculture*, a plant of the weed kind, found in coppices, and on the banks of rivers, which sheep are said sometimes to eat. The common sort is thought by some to be useful in epilepsies.

SMOKE, or SMOAK, *Fumus*, a humid matter, exhaled in form of vapour by the action of heat, either external or internal; or smoke consists of palpable particles, elevated by means of the rarefying heat, or by the force of the ascending current of air, from bodies exposed to heat; and these particles vary much in their properties, according to the substances from which they are produced. See FLAME.

Smoke, Sir Isaac Newton observes, ascends in the chimney by the impulse of the air it floats in: for that air, being rarefied by the fire underneath, has its specific gravity diminished; and thus, being determined to ascend itself, it carries

carries up the smoke along with it. The tail of a comet that great author takes also to ascend from the nucleus, after the same manner. (See COMET.) Smoke of fat unctuous woods, as fir, beech, &c. makes what we call lamp-black.

Smoke, arising from the combustion of vegetables, is a mixture of water, oil, volatile salts, and all the gaseous products which result from the combination of vital air with the several principles of the vegetable.

There are various inventions for preventing and curing smoky chimnies; as the æolipiles of Vitruvius, the ventiducts of Cardan, the windmills of Bernard, the capitals of Serlio, the little drums of Paduanus, and several artifices of De Lorme. See CHIMNEY and FIRE-Places.

In the Philosophical Transactions we have the description of an engine, invented by Monsieur Daleme, which consumes the smoke of all sorts of wood, and that so totally, as the most curious eye cannot discover it in the room, nor the nicest nose to smell it, though the fire be made in the middle of the room. It consists of several iron hoops, four or five inches in diameter, which shut into one another, and is placed on a trevet. A brand taken out of the fire smokes instantly, but ceases as soon as returned: the most fetid things, as a coal steeped in cat's piss, which stinks abominably when taken out of the fire, yet in it makes not the least ill scent; no more than red-herrings broiled, &c.

SMOKE-Jack. See JACK.

SMOKE-Farthings were the pentecostal or customary oblations offered by the inhabitants within any diocese, when they made their processions to the cathedral church; which came, by degrees, into an annual standing rent, called smoke-farthings. See PENTECOSTALS.

SMOKE-Silver, in our *Old Writers*. Lands were held in some places by the payment of the sum of six-pence yearly to the sheriff, called smoke-silver.

Smoke-silver and smoke-penny are to be paid to the ministers of divers parishes as a modus, in lieu of tithewood; and in some manors, formerly belonging to religious houses, there is still paid, as appendant to the said manors, the ancient Peter-pence, by the name of smoke-money.

SMOKEY BAY, in *Geography*, a large bay on the west coast of the entrance into Cook's river, between Cape Douglas and Point Banks.

SMOLEN, an island in the North sea, on the coast of Norway, 25 miles in circumference. N. lat. 63° 24'. E. long. 8° 26'.

SMOLENSK, a town of Russia, and capital of a government, situated on the Dnieper; the residence of a governor, and a bishop's see, with very considerable commerce. The possession of it has been often disputed between the Poles and the Russians. It is built on two hills, between which are a valley and river, and surrounded with walls, 30 feet high and 15 thick, the lower part being stone, and the upper brick, which trace the course of the hills, and enclose a space of about five miles. At every angle towers are erected. The houses of the common people are mostly constructed of wood: the number of inhabitants is said to exceed 4000. The chief articles of trade are flax, hemp, timber, masts, planks, honey, wax, hides, hogs' bristles, and Siberian furs; 420 miles E.N.E. of Warsaw. N. lat. 54° 40'. E. long. 32° 18'.

SMOLENSK, a government of Russia, bounded on the north by Plovskoe and Tverskoe, on the east by Moscovkaia and Kaluzskoe, on the south by Orlovskoe and Novgorod Sieverskoe, and on the west by Polotzkoe and Mogilevskoe; at its greatest length 180 miles from N. to S., and 160 from E. to W. This government contains White Russia, pro-

perly so called, and was ceded by Poland to Russia, as a duchy, by a treaty, concluded in the year 1667, and confirmed in 1686. Its capital is Smolensk. N. lat. 53° 20' to 56° 15'. E. long. 31° to 36°.

SMOLIN, a town of Hungary; 22 miles N.N.E. of Presburg.—Alfo, a mountain of Bosnia; 32 miles S.S.W. of Zwoornick.

SMOLLET, TOBIAS, in *Biography*, a writer of considerable reputation, was born, in 1720, at Dalquhurn, in Dumbartonshire. After a common education he was put apprentice to a surgeon in Glasgow, and at the same time he availed himself of the opportunity of attending medical lectures at the university. At this early period he composed a tragedy. In his nineteenth year he quitted Scotland for London, where he quickly obtained the situation of surgeon's mate in the navy. He failed in the expedition fitted out against Carthage, under admiral Vernon and general Wentworth; and during the voyage he displayed his powers of observation, as well as his satirical turn, by the account he drew up of that ill-conducted and unsuccessful enterprise. He was soon disgusted with the service in which he had engaged, and quitted it in the West Indies. It had, however, been of great service, by introducing him to that acquaintance with the manners and language of sailors, of which he made the most amusing exhibitions in his novels. The savage cruelties used by the king's troops after the battle of Culloden called forth Smollet's warmest feelings, and occasioned his poem entitled "The Tears of Scotland," which by its spirit and elegance placed the author high in the rank of minor poets. It was followed by two satires, a species of composition to which the natural irritability of temper gave him a propensity. He married, in 1747, a lady, with whom he expected a good fortune, of which, however, he received very little, and the expensive style in which he set out in life brought him very soon into serious difficulties. In this emergency he had recourse to his pen, and in 1748 he produced his first novel, entitled "Roderick Random," which had no doubt strong allusions to his own history, and became extremely popular. "A trip to Paris, in 1750, enlarged his knowledge of the world, and gave rise to his "Adventures of Peregrine Pickle," in which he exerted all the powers of humorous invention and delineation, though often at the expence of delicacy and morality. He now determined to pursue his profession, and commenced physician at Bath, but he met with so little success that he soon abandoned it, and resumed writing as a profession. His next publication was "Adventures of Ferdinand Count Fathom," which was followed by a new translation of Don Quixote. In 1756 he undertook the management of a new Review, under the title of the "Critical," which, after undergoing a number of changes, still exists. His satirical and acrimonious spirit soon broke out in this journal, and involved him in a quarrel with admiral Knowles, on whose conduct in the expedition to Rochefort he had spoken with great severity. Smollet was prosecuted and convicted of a libel, and suffered the punishment of the law, viz. fine and imprisonment.

After this he wrote for the theatre an after-piece, entitled the "Reprisal, or the Tars of Old England;" this was acted at Drury-lane in 1757; and in the following year he published a hastily written "Complete History of England, from the Descent of Julius Cæsar to the Treaty of Aix-la-Chapelle," in two vols. 4to. About the same period he published a novel, entitled "The Adventures of Sir Launcelot Greaves," and he is supposed to have written the histories of France, Italy, and Germany, in the modern part of the Universal History. In 1761 he began to publish his

"Continuation of the History of England," taken up at the Revolution, where Hume left it, and brought down to the year 1765.

At the beginning of the present reign, Dr. Smollet was an advocate in defence of the measures adopted by the administration, at the head of which was lord Bute, and in connection with others he published a weekly paper, called "The Briton," which was encountered by the more famous one entitled "The North Briton," set on foot by the well-known John Wilkes. The rancour displayed on both sides dissolved the friendship which had long subsisted between these two political champions. Smollet, from some domestic afflictions, determined to visit the continent, whither he went in 1763, and he spent two years in a tour through France and Italy. After his return he published, in 1766, his "Travels" in these countries, in a series of letters, in two vols. 8vo. which contained many lively and sensible remarks, but which were deeply tinged with the gloomy temper of mind, which rendered him dissatisfied and out of humour with almost every thing he saw. In 1769 he published a sort of political romance, entitled "The Adventures of an Atom," intended to ridicule different administrations, but especially that of the earl of Chatham.

Increasing ill-health induced him, in the year 1770, to pay another visit to Italy, accompanied by his wife, and during his last voyage he wrote his last novel, "The Expedition of Humphry Clinker," which some critics regard as the best of all his novels. He died in the neighbourhood of Leghorn, in October 1771, in the fifty-first year of his age. "Dr. Smollet," says the author of the article in the General Biography, "was undoubtedly a man of talents and great variety of powers, though he did not attain the highest rank in any thing. He is best known as a novelist, and they who read those compositions for amusement only, without much nicety of taste, seldom fail of being entertained by him. Yet his portraits are often caricatures, his scenes of humour coarse and extravagant, and his jests borrowed. As an historian, he has attained more credit for the elegance and animation of his style, than for the higher qualities of judgment, accuracy, and impartiality; and though his continuation is annexed to Hume's History, the two writers will bear no comparison." His poetic powers were considerable. His "Tears of Scotland," "Ode to Leven Water," and some other short pieces, are polished, tender, and picturesque. His "Ode to Independence" is a loftier flight, and has perhaps few superiors in the lyric strain. His satires are vigorous, but violent and disgusting.

SMOLNITZ, in *Geography*, a town of Bohemia, in the circle of Schlan; 12 miles W.N.W. of Schlan.

SMORGONIE, a town of Russian Lithuania, in the palatinate of Wilna.

SMORZATO, in *Italian Music*, for the violin family, implies that the bow should be drawn or pressed to its full length, not with the same force throughout, but lighter by degrees, till scarcely any sound is heard. This term seems now superseded by *diminuendo* and *perdendosi*.

SMOSTRIE, in *Geography*, a town of Poland, in Polandia; 15 miles N. of Kaminiac.

SMOTHER-FLY, in *Agriculture*, a provincial term applied to the bean aphid.

SMOTRZICZ, in *Geography*, a river of Poland, which runs into the Dniester, 8 miles S. of Kaminiac.

SMRDOW, a town of Bohemia, in the circle of Czafslau; 9 miles S. of Czafslau.

SMUGGLING, a cant term for the running of goods, or the offence of importing them without paying the duties
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imposed thereon by the laws of the *customs* and *excise*. See each of these articles.

This is restrained by a great variety of statutes, which inflict pecuniary penalties, and seizure of the goods, for clandestine smuggling; and affix the guilt of felony, with transportation for seven years, upon more open, daring, and avowed practices: but the last of them (19 Geo. II. c. 34.) is for this purpose *instar omnium*; for it makes all forcible acts of smuggling, carried on in defiance of the laws, or even in disguise to evade them, felony without benefit of clergy. For the chief provisions of this act, which was at first temporary, but made perpetual by 43 Geo. III. c. 15, see CUSTOMS.

SMUSH-POT, amongst *Painters*, is the vessel into which they rub off the paint from the pencils, and put the scrapings of the pallet.

SMUT, or USTILAGO, in *Agriculture*, a disease in corn, and which, according to M. Duhamel, exhibits the following marks or appearances. 1. This distemper destroys entirely the germ and substance of the grain. 2. It affects not only the ear, but also, in some degree, the whole plant, when it has made a great progress. 3. It very seldom happens, but that when one stalk is smutty, all the ears of the other stalks from the same root are so too. 4. So early as in March or April, upon opening carefully the hood or blades which cover the ear, and examining the young ear, then not above the sixth part of an inch in length; and almost close to the roots, he found this embryo already black, and attacked with this distemper. Perhaps it may not always seize the plant so early. 5. When the distempered ear comes out of its covering formed by the blades, it looks lank and meagre: the common, and immediate coverings of the grains, are in this case so very slight and thin, that the black powder is seen through them: and from this time nothing is found in lieu of grain, but a black powder, which has a fetid smell, and no consistency. As this powder, of which the constituent particles have but very little cohesion, and of which the coverings are destroyed, is easily blown off by wind, or washed away by rain; the husbandman, in housing these plants, houses only skeletons of the ears. If any impression of this powder remains, it is easily taken off by sifting; but he has not experienced it to be contagious, like that of burnt grain. And Mr. Tillet, it is remarked, has observed that these corrupted ears are often found to be vitiated even in the hood, though this last looks as green and perfect as if nothing ailed the corn within. The upper part of the stalk of a smutty plant is not commonly quite straight, from within about half an inch below the ear. If such a stalk is squeezed there, it scarcely yields at all to the pressure. If it be cut asunder at about a sixth part, or a quarter of an inch below the ear, it will be found to be almost entirely filled with pith, in such a manner that only a very small opening can be perceived in the heart of the stalk, instead of the large pipe that is in healthy stems. He concludes from hence, that the circulation of the juices is obstructed in the upper part of the stalks of smutty plants. Bearded wheat is apt to be smutty, as well as that which is not bearded; but neither Mr. Tillet nor he ever met with a smutty ear of rye.

And in respect to the causes of smut, it is observed, that the smuttiness of corn cannot be owing to a want of fecundation, as many have hitherto mistakenly imagined, since it affects and destroys the organs of both sexes, long before the time of that fecundation:—that it cannot be imputed to the setting of wet upon the ears, or to fogs, or to a violent impression of the sun; since we have seen the ears
B b smutty

smutty long before they ceased to be covered with the blades, which continue green till the distemper has made great progress:—that the same observations refute absolutely the opinion of those who suppose the cause of the smut to be in the grains after they are formed, and before they are past their milky state:—that the smut of corn has been also ascribed to the moisture of the earth; but we do not see more smutty plants in the lowest, and consequently wettest parts of a field, than in the highest and most dry. Besides, why should there be a single smutty plant in the midst of numbers of found ones? However, as it appears that corn is more frequently attacked with this distemper in wet years than when the seasons are dry, too much moisture may perhaps, without being the immediate cause of the smut, favour its progress more than drought would do.

Some naturalists have ascribed this distemper to insects. Our author, if he is not authorized absolutely to deny this, can at least assert, that, after having been of this opinion for some time, all his endeavours to establish it by facts have proved ineffectual. Some observers have indeed shewn him different insects in smutty grains; but as he found the very same kinds likewise in found ears, he believes, with Mr. Tillet, that they are not in any manner the cause of this distemper. We know that the corn-caterpillar devours the mealy substance of the grain; but it does not occasion smut. Numbers of flies lay their eggs upon these seeds, and the worms and maggots which proceed from them eat the seeds; but this does not occasion any thing like smut. The Rev. Dr. Hales, to satisfy himself whether the smut of corn might not proceed from the seeds being bruised by the flail, took a number of grains, of different sizes, and bruised them with a hammer. Thus his own experience convinced him that he had conceived a wrong idea of the cause of this distemper.

Several cultivators have thought that pigeons' dung and that of sheep render corn smutty: but this is a groundless notion. We have large pigeon-houses, the dung of which is strewed upon our wheat-lands; yet we do not find that these fields are more affected with smut than others. This allegation is, therefore, absolutely destitute of proof. It is added, that Wolfius was of opinion that the smut of corn proceeded from a monstrosity of the embryo; but M. Almen has refuted that supposition, by shewing, that the male flowers of certain kinds of plants are attacked with this distemper: now the flowers have not any embryo.

And this last philosopher has judiciously observed, that the smut of corn cannot derive its origin from a defect in the sap; as all the parts of the plant, except the ear, look healthy, and there are plants whose roots are perennial, which appear vigorous, though their feeds are smutty every year. He is of opinion, that whatever weakens the plant is apt to bring on the smut, and instances as a proof of this, that it is a frequent custom in his country, to cut rye as soon as it spindles, for food for their cattle; and that this rye generally produces other ears, which seldom contain any but distempered grain: to which he adds, that seed-corn which had been pricked or run through with a needle, or which is not thoroughly ripe, and that which produces lateral or second ears, is subject to the smut. And he afterwards, from other trials, seems disposed to ascribe this disease to mouldiness.

But in the "Memoirs of the Bath Agricultural Society," it is said to be a disease that only occurs when the weather is wet, during the period of the flowering of the plants, in which the anthers may burst and the farina be washed way. It is supposed not to be produced by any infectious material, or the *ova* of insects that may adhere to the grain, as

smutty ears and found ones are found proceeding from the same root; and, in some instances, both smutty and found grains to be contained in the same ear; some of the corns having even one end smutty and the other found, consequently to arise from the want of due impregnation, from the farina fecundans being faulty or imperfect, and that putrefaction takes place on the death of the corn. And this supposition is supported by the experiments of the Italian philosopher Spallanzani, who found that the seed is produced in the plants long anterior to impregnation, which cannot be performed until the flower is open, and the dust of the anther fully in a state of maturity. And Dr. Darwin, on these principles, conceives, that for want of impregnation, or the vivifying principle, the wheat-corn may putrefy, as is the case with addle eggs of oviparous animals. However, the inquiries of other writers seem to lead to the opinion that the affection is produced by the attacks of an insect, and that, though certainly infectious, it may be prevented or cured by the use of different kinds of pickles.

Further, a variety of facts and reflections have been offered on this subject by Mr. R. Somerville, in the second volume of "Communications to the Board of Agriculture;" who begins by remarking, that some years ago, he collected a quantity of smutted ears from one field of wheat, in which they were very numerous, and a number of healthy well-filled ears from another field, in which there was no smut. The grains were rubbed out of both, intimately mixed, and kept in a box for two months, at the end of which time they were rubbed between the hands in such a manner as to break the whole of the smut-ball. The parcel was then divided into two equal parts, one of which was three or four times washed with pure water, and well rubbed between the hands at each washing, and afterwards sown in a drill in his garden; the other half was sown in another drill without any washing or preparation whatever, the soil and every other circumstance being equal. Both parcels vegetated at the same time, and for about two months thereafter there was no visible difference in their appearance; about that period, he however observed, that many of the plants in the drill that had been sown without being washed, were of a darker colour than the others; these, when narrowly examined, were of a dirty-green. The plants in the drill that had been washed were all of one colour, and seemingly healthy; as the season advanced, the difference in colour became more striking, and continued to increase till the grain was fairly out of the blade: about this time many of the dirty-green ears began to exhibit symptoms of decay. As soon as the ear was fairly shot out, the whole of those in the unwashed drill, that had the dirty-green appearance above described, were found to contain nothing but smut; and these smutted ears were in the proportion of more than six to one of the healthy ones; while, on the contrary, the drill in which the washed grains had been sown, and which consisted of several hundred grains, had hardly a smutted or unhealthy ear in it. The same experiment was repeated the following season, and with nearly the same result. Satisfied with knowing that complete washing would be found a remedy for the disease, he made no farther inquiry upon the subject till last autumn, when he was employed in making observations upon the blight, in the course of which he met with a good deal of smut in many fields; and being at the time possessed of some excellent glasses, he carefully examined some of the smutted plants. This at first was done more as a matter of amusement, than from any expectation of discovering any thing that might contribute to throw light upon the subject.

subject. Upon a near inspection with the glass, he found that the dirty-green colour of the blades of the smutted ears was owing to a number of spots infinitely small, and bearing a near resemblance to those upon blighted ears: his observations were continued throughout the whole period of the ripening, in the course of which he made no additional discovery, except observing, that the leaves and stalks of the smutted ears decayed sooner than such as were healthy. About the end of autumn, however, having one day brought home some smutted ears of rather an unusual appearance, he examined them very narrowly, and observed that the balls were perforated in many places with small round holes, a thing he had not before observed in any that he had met with: this he ascribed to vermin; and upon sticking one of the grains upon a pin, and placing it under the glass in a very bright sun, he could distinctly observe several small transparent specks upon the beard, or downy part of it. He examined several more, and met with exactly the same appearance; but upon being called hastily away upon business, he was under the necessity of leaving them upon the table, without being able to ascertain whether the objects he had seen were eggs or insects. In the evening, when he came home, he resumed the investigation by *candle-light*; in the course of which, as he was under the necessity of holding them very near the candle, the heat soon relieved him from his embarrassment, by putting them in motion, and he then discovered that the specks above-mentioned were real insects, resembling wood-lice in shape. Next day he repeated the same trials by sun-light with new smut-balls, and discovered the same appearances, but without being able to make any of the insects stir. Disappointed and vexed at not being able to see them in motion with the sun-light, and recollecting the heat of the candle, he threw the concentrated rays of the sun upon them with a burning-glass, which completely answered his purpose of putting them in motion, and shewing them in every different point of view. To describe minutely an insect so small as not to be distinguishable by the naked eye, would, he thinks, be no easy matter; it is sufficient to say, that its general appearance is very similar to the wood-louse, though infinitely smaller. As soon as he had clearly ascertained the existence of this insect, his mind was perfectly at ease with regard to the cause of the distemper; but though he could very readily conceive that vermin, in the early stages of the growth of a plant, might so injure the stamina as to render it unfit to produce any thing but smut, he could not so well understand how it was possible for the mere touch of the black earth contained in the smut-balls to produce the same effect. It is well known, that in the animal body, certain infections are communicated merely by the contact of the sound and unsound parts; but that in every instance where this happens, the injury can be distinctly traced to an absorption of the virulent matter, by the vessels of the healthy subject.

And we are now, he thinks, so well acquainted with vegetation, as to know that plants have a circulating system as well as animals; and that while they are in a growing state, poison as well as nourishment may enter their vessels, and do infinite mischief. If this reasoning is sanctioned by experience, and there can be no doubt of it, and if there is the slightest analogy between animal and vegetable life, it will at once appear, that no bad effect could possibly arise from smutted and healthy ears coming in contact, either in the stack or the barn, as at that time they are in a state of rest, and no circulation going on. It may be argued in answer to this, that while the plants are green, the shaking of the wind may bring the smutted and the healthy ears

into contact, and that the acrimony of the smut may corrode and destroy the healthy wheat, so as to produce the disease. This idea he knows is entertained by many very good farmers: it is, however, clearly disproved by the experiment above recited, by which it appears that a simple washing in water, provided it is properly performed, is a very effectual cure for the distemper: common sense will inform us, that had the stamina, or germ of the grains so washed, been injured by any thing of a corrosive nature, even in the slightest degree, no ablation whatever could possibly have repaired the mischief. And the same reasoning, he supposes, applies with equal justice to the other causes assigned, with the single exception of insects; for if either the grain was naturally weak, or had been sprung in harvest, or was deficient in its male organs, as is ridiculously supposed, nothing but the highest degree of weakness and credulity could make any person believe, that either the washing with water, or indeed any other preparation, could cure such defects.

It is, therefore, his opinion, that the smut is occasioned by the small insect above described, as seen by the glass in the downy part of the grain; and that when the balls are either broken in the operation of thrashing, or come in contact with clean healthy grains, the insects leave the smutted grains, and, adhering to such as are healthy, are sown with them, and wound the tender stem in such a manner as to render the plant incapable of producing any thing but smut. It is not an easy matter to account for the manner in which this takes place; but a little attention to the circumstances he is now to mention will perhaps throw some light upon it. It is known that plants of very opposite natures and qualities will grow and produce abundantly upon the same soil, where the nourishment is seemingly the same. This effect is also known to be owing to the structure of their vessels, by the action of which the juices that circulate through them are differently prepared in every different plant. From this striking difference, owing confessedly to organization, is it not, he asks, presumable that the smut in wheat is produced by the insects wounding the vessels of the plant in such a manner as to render them incapable of taking up any other principle from the soil, but the smut contained in the balls, which, upon examination, seems to have no quality different from the finest vegetable earth? This opinion, he thinks, is strongly supported from the circumstance of certain pickles being found a cure for the malady. The effect of these pickles is, however, completely misunderstood; for, in place of supposing, as is erroneously done, that they operate by strengthening the grain, and thereby removing that debility which has been long considered the cause of smut, their benefit depends upon the powers they possess of destroying the insects above described: but to shew the absurdity of the commonly received opinion in a more striking point of view, it is only necessary, he adds, to state, that many of these preparations, which are supposed to be so friendly to vegetation, are in fact inimical to it, unless they are used with the utmost caution; even stale urine, which has long been considered as a safe and innocent remedy, is, under certain circumstances, highly pernicious. After he had discovered the insect, he made trial of all the substances commonly used, and found all of them, when properly applied, destructive to it. Is it not, therefore, he contends, more agreeable to plain common sense to suppose, that the virtue of these preparations consists more in the power they have of destroying vermin, than in any strengthening quality they possess?

The following opinion has been offered on this vegetable

SMUT.

table affection by sir John Call, who supposes, that the smut is occasioned by certain animalcula deposited in the husks of the ear, when the wheat is in blossom, which are fed and brought to perfection by devouring the milky juice, and observes, that were the disease radical in the original grain of the feed-wheat, or infectious from the juice arising through the pores and tubes of the stalk, there could not be in the same ear, grains, some decayed and others quite perfect. But to bring the matter to the test of experiment, he collected a quantity of smutted ears of wheat, in some of which were two or more grains apparently perfect, all which he caused to be rubbed out with the hand in a bag, smut and altogether; the fresh grains found in the bag were then sown in a particular ridge amongst other wheat, in a field under tillage. Their growth from the first was similar to the rest of the wheat; and from a certificate of respectable farmers, it appears their produce was as free from smut, as that of the field in general. And hence the conclusion is drawn, that washing or pickling wheat, as a remedy against the smut, is unnecessary and useless; and that as blights and other diseases of plants are more prevalent from circumstances in some seasons than in others, so the smut is an accident of a like nature, which mankind can neither foresee nor prevent. The general

experience of farmers is, however, in opposition to this supposition. And whether this vegetable disease may be produced by insects, or be the effect of some other cause, to many of which it has been ascribed by different philosophical inquirers; the most general practice of farmers has been that of preparing their seed by the means of some sort of washing or brining. The following is a tabular view of the results of trials made with different steepes, in order to ascertain their utility in this intention, as well as in promoting the growth of the grain, as given by Mr. Bevan, in the 9th volume of the "Agricultural Magazine." It contains twelve samples of smutty wheat, and the same number of sound good wheat, steeped in twelve different solutions of the most common acids and alkalies, and salts, most readily procured. The wheat was sown at Leighton, Bedfordshire, on a sandy soil. The solutions were all made cold, and the samples continued about twenty-four hours in steep. The columns marked A are the results from the good wheat, and those marked B are from the smutty samples. It may be observed, that neither of the samples steeped in the solutions of nitric acid came up, excepting a single corn in the good sample, and which produced above 1200 corns from it.

Kinds of Substances used.	Specific Gravity of the Solution.	Number of smutty Ears in Three Sheaves.		Bushels of good Wheat, per Acre.		Cwts. of Straw, per Acre.	
		A.	B.	A.	B.	A.	B.
1. Solution of potash - - - -	1.357	1	81	21.6	13.6	36.6	29.1
2. ——— of muriate of potash - -	1.097	3	218	20.2	10.1	36.0	21.1
3. ——— of nitrate of potash - -	1.080	7	115	23.8	14.3	36.9	31.9
4. ——— of soda - - - -	1.056	9	159	20.2	11.7	35.6	26.7
5. ——— of murate of soda - - -	1.089	—	290	24.0	14.5	41.5	33.3
6. ——— of sulphate of soda - - -	1.047	12	241	21.6	12.3	38.5	27.8
7. ——— of muriate of ammonia - -	1.026	1	150	19.8	17.6	35.4	30.2
8. ——— of common foot - - - -	1.025	—	123	20.8	11.4	34.8	25.3
9. ——— of lime saturated - - - -	1.003	—	2	21.9	12.4	38.7	25.9
10. ——— of nitric acid - - - -	1.016	—	—	—	—	—	—
11. ——— of muriatic acid - - - -	1.011	—	136	2.07	16.1	35.7	34.1
12. ——— of sulphuric acid - - - -	1.050	—	—	2.04	17.8	35.4	37.1
13. Dry in its natural state - - - -	—	6	323	20.3	14.7	35.7	31.1
14. Washed in common water - - -	—	None sown. }	107	—	18.3	—	35.8

But M. de Lignerolle contends, that the surest means of avoiding smut, and that which he has long practised with success on upwards of three hundred acres of land, is to change the seed every year, to be very careful that the feed-corn be well dried and thoroughly ripe, and that it be not smutty, nor have any smutty powder sticking to it. He then pours boiling-water on quick-lime, in a large tub; and after the ebullition is over, as much cold water as there was hot, and stirs it all strongly together, in order to dissolve and thoroughly mix the lime. The quantity of wheat intended to be sown is sprinkled with this ley, and then well stirred with a shovel, and laid in as high a heap as possible. It is best, he supposes, to keep the grain for a week after this preparation, turning it every day; for otherwise it would heat so as to destroy the germ. By these means he has not had any smut, when the fields around him have been infected with that distemper. And Mr. Donat, near Rochelle, has used the following with success: take quick-lime and pigeons' dung, of each twenty-five pounds, forty pounds of wood-ashes, and twenty-five pounds of sea-salt, or salt-

petre. Put all these into a tub large enough to hold half a hog-shead of common water, which should be added to them. Stir them all well with a stick, till the lime is quite dissolved. This ley will keep some time without spoiling. It must be stirred just before the corn is steeped in it. The grain is then put into a basket, and plunged into the ley, where it remains till it has thoroughly imbibed it; after which it is taken out, and laid in a heap till it is quite drained of all its moisture: or, which is a still better way, take a mashing-tub, fill it with grain to within four inches of the brim, and then pour in the ley well stirred before-hand. When the tub is full, let the ley run out at the bottom into some other vessel, in order to use it again for more corn. Let the grain be then taken out and laid in a heap to drain; and continue in this manner to steep all the feed-corn. The wheat, thus prepared, may be sown the next day, and must not be kept above five or six days, for fear of its heating. This quantity of ley will serve to prepare more than twenty bushels of wheat. Mr. Tull has also long since observed, that brining and changing the feed are the general remedies for

for smut. Likewise a very intelligent writer in the eleventh volume of the Agricultural Magazine says, that he can truly state, that in the course of long and extensive practice, he has never discovered the produce of any good and properly prepared feed-wheat smutted, while that of his unprepared escaped. On the contrary, whenever he has sown any in the latter state, he has always observed much smut in the crops raised from it; and refers his readers to the following account of an accurate comparative statement. On the 15th of March last he sowed two contiguous ridges (in the middle of a very large field,) equal in soil, condition, and exposure, with wheat of the same variety, raised on the same kind of soil, in precisely the same mode of management, and thoroughly mixed. The seed contained a very small quantity of smut, perhaps one black ball to a quart; but the other grains were not at all discoloured. The ridges were set out in an east and west direction, each eighty yards long and nine broad. On the west half of the northern ridge he sowed the seed without any preparation whatever; and on the east, after being well washed in clean river-water. On the west half of the other ridge the wheat was sown after having been wet with old chamber-ley; and on the east half, after being prepared (provincially pickled) in the usual manner, with old chamber-ley and lime in fine powder. All the land was ploughed and sown broad-cast on the same day, without any variation of weather, and equally well harrowed. We had a calm, dry, and tolerably warm blooming season. Some time after the ears were out he examined the crop very minutely. That after the unprepared seed, the washed seed, and the wheat wet with chamber-ley, contained a great, and that from the seed which received the chamber-ley and lime, a very small, quantity of smut. The straw of this appeared as good as that of the sound wheat. Upon every piece of ground he found ears partly smutted and partly sound. In part of these ears he found some rows of grain containing sound wheat near the middle of the row, and smut both above and below it. With a view of finding the proportion (at harvest) with some degree of precision, he took four sheaves from the middle of the crop raised from the pickled seed, mixed them thoroughly, reduced them to an equal size, viz. to the circumference of twenty-four inches, and then carefully picked out and counted the number of smutted ears they contained. He pursued precisely the same mode with the crops upon the other pieces of ground, and the results were as under:

	Smutted Ears.
The four sheaves after the pickled seed contained	165
The four do. from the seed which was washed in clean water	1212
The four do. from the seed wet with chamber-ley	723
The four do. from the seed which received no wash- ing or preparation	1270

It is supposed that it is stated in some of our agricultural publications, that one of the strong acids, much diluted with water, has been successfully used in preparing feed-wheat, with a view of preventing smut; a disease which has been improperly confounded with blight or mildew. The latter remedy he never tried; he has, however, on several occasions, used sea-water (so strongly impregnated with salt, that an egg would swim on it) and lime, and also the drainings of fold-yards and lime, and is of opinion that these mixtures are not nearly so efficacious as the latter article and strong chamber-ley. The best mode of preparation is, he thinks, to immerse the wheat in the chamber-ley, stirring it well

(about five or ten minutes), and skimming off the light grains, &c. The chamber-ley should be let out by a tap, and the wheat spread on a floor, and so well mixed with the lime that every grain may receive a part of it. If this mode be carefully practised with seed free from smut, he can, from experience, assure the husbandman that he will never suffer, in any considerable degree, from that disease. As the lime and chamber-ley will soon destroy the vegetative principle of the grain, if it be suffered to remain in a heap, or in bags, it should be committed to the ground within six or eight hours after it has been thus prepared. He has sometimes known it considerably injured after being kept twenty-four hours thinly spread out upon a well aired floor. And as, when the seed is in a very moist state, it will not pass regularly through the drill-machine, it is necessary on that account to have it drier in the drill than the broad-cast husbandry.

When the wheat used in the above experiment was prepared, a proper vessel was not at hand, and therefore the chamber-ley was sprinkled upon it. This, however, is not a good method, for we lose the chamber-ley, and the advantage of skimming off the light grains, black balls, &c.; and notwithstanding frequent turnings, it sometimes happens that all the grains do not receive a sufficient quantity of the liquid. A proper vessel should therefore be constantly had recourse to for this purpose.

But on the supposition of this diseased state of grain being produced by an insect, the following method of kiln-drying has been proposed in the third volume of the Farmer's Magazine. Let the wheat be laid upon the kiln about three or four inches thick, the kiln being heated middlingly strong with blind coal; the wheat to continue on the kiln for twenty-four hours, but turned frequently. After taking it off the kiln, it must be allowed twenty-four hours to cool, during which time it must be frequently turned, and then put through the fanners once or twice. After the wheat has lain a few hours on the kiln, and the fire begins to have effect, a great number of very small worms, formerly undiscovered by the eye, appear on the top of the grain, and are soon destroyed by the heat. These come from blacked wheat or other corns that could not be suspected to be indifferent; or may lie in, or on good wheat, which worms continuing, (when not thus killed,) might consume the corn after it is thrown into the earth, thereby checking the growth entirely, or preventing it from having the strength it otherwise would have, to bring forth a strong productive stalk. It is added, that the first farmer in Clackmannanshire who tried the kiln-drying of wheat, instead of pickling it, learnt it about twenty-five years ago (and he has continued the practice ever since) from an Irishman, who had been appointed by the Board of Trustees to stamp the linens, &c. manufactured in the village of Alva, who asserted that it was practised in his part of Ireland; but at this distance of time, the farmer has forgot what part of Ireland the man said he came from. See PICKLE and STEEPING.

Further, with the view of cleaning smutty grain; various methods have been proposed; as by agitating it with different substances, as sand, and lime made from floue, or white or grey chalk, which, when used, should be finely sifted, and then well blended with the wheat in proportion to the state of the smut, as from one to two bushels for a load of five quarters, which should then be passed through a machine one or more times, according to the purpose for which the wheat is intended. And for common purposes, it is supposed that the smut in wheat may be removed by a machine with brushes, invented for the purpose; but that if it be for feed, it should be put in a trough, or wicker receiver, under the spout of a pump, or the fall of a stream, and be briskly stirred

stirred about, until the injurious substance floats away, or can be skimmed off from the surface. When intended for flour, after this washing, it must be dried on a malt-kiln for the space of eighteen hours, but heated so as not to exceed 85° of Fahrenheit's thermometer. The representation of a machine contrived for this use, may be seen in the Corrected Agricultural Report of Berkshire.

M. Chantran presented a memoir to the French National Institute in 1799, on the smut in wheat, and its acid. After remarking, that stalks which bear charred ears do not differ from others, and that these ears often contain good and bad grains, he thought himself authorized to advance, that this disease does not exist, as generally believed, in the germ of the seed from which they sprung. However, he does not consider liming the seed as useless; he thinks that it destroys the animalculæ attached to the seeds, and that the reason of its not entirely extirpating the smut, is because it cannot act on those small insects which occasion it, and which happen to be scattered in the ground.

Having analysed forty-six grains of smut, he found in this substance an acid easy to be demonstrated. For this purpose, boiling water being infused over it, gave a strong tinge of red to tincture of turnsole, while the remainder of this tincture retained its former character. Smut, deprived of the acid, and calcined in the open air, emitted the odour of burnt corn, and gave a residuum six times as large as the same quantity of the farina of wheat treated in the same manner. This, joined to microscopic observations, says Chantran, proves the animal nature of this substance, and a difference between it and the farina of wheat greater than could arise merely from disease. The acid of smut is not volatile, and may be concentrated by distillation. With lime and with ammonia it proves an insoluble salt; and this distinguishes it from the phosphoric acid. Combined with potash it gave a salt crystallized in small deliquescent needles of a bitter taste. It decomposes carbonate of lime.

SMUT, or *Blacks*, in oats, a sort of vegetable disease that often occurs or takes place in crops of this kind, in much the same manner as that of smut in wheat, in many of the country districts. It is said by some to affect the whole of the ear of the grain, being occasionally met with in different stages of its progress in the standing crops, as well as at the time of threshing out the corn, as in those of a soft unctuous state, in the state of a ball, and in a powdery state, or that of a fine dust, which disperses itself in threshing, and fixes upon different parts of the faces of the men who thresh, rendering them quite black. But others, probably without sufficient observation or knowledge of the fact, suppose it to be a plant growing separately among the oats.

It is an affection of this sort of grain which happens frequently on the eastern side of the county of Lancaster, in the life of Man, and in several other situations. It is found to prevail less among the potatoe oat crops than those of any other sorts of that grain, and to be much more prevalent in some years than in others.

No effectual method of preventing it has yet been discovered, but it is found to be much lessened by the good cultivation and management of the land on which this sort of crop is grown. The oat crops, where it exists to any considerable extent, are much less productive than in other circumstances, and the quality of the produce is probably not so good. But the diseased substance is so light in its nature, that it is readily blown away in dressing or cleaning the grain without its doing much mischief to it.

SMUT-Balls, the small balls of smutty matter which are found among diseased wheat and other crops. These balls, as well as the diseased parts of the crops, appear now, from

actual experience, to be constantly of a very infectious nature, and should, of course, be as much guarded against, and cautiously avoided, in preparing the seed of the crops for sowing, as possible; as it is not improbable, but that the disease may sometimes be communicated and propagated in this way, without the farmer being in the least aware of it. See *STEEPING Seed-Grains and Seeds*.

SMYNHUSEN, in *Geography*, a town of the duchy of Holstein; 6 miles E. of Lunden.

SMYRHIZA, in *Botany*, a name used by Pliny, and some other old authors, for the common myrrhis, or chervil.

SMYRNA, in *Ancient Geography*, one of the Ionian towns of Asia Minor, situated towards the northern part of the isthmus of the peninsula of Colophon, upon a gulf bearing the name of the town. This town is very ancient, and is said to have been founded by the Smyrnæans, who inhabited a quarter of Ephesus called "Smyrna," from whom it derived this name. Being expelled by the Æolians, they retired to Colophon; but the Colophonians having been obliged to expatriate themselves on account of sedition, found an asylum among the inhabitants of Smyrna. Some time afterwards, finding that the Smyrnæans celebrated without their city a feast in honour of Bacchus, they shut the gates and took possession of the town. The Æolians came to their succour; but it was at length determined, by common consent, that they should leave the Ionians in possession of the town, and withdraw themselves with all their moveable effects. The Smyrnæans having accepted this condition, they distributed themselves into eleven other Æolian cities, where they obtained the right of citizenship. At a subsequent period the Lydians took possession of Smyrna under Ardys; and having destroyed it, the inhabitants dispersed themselves into different districts. Four hundred years afterwards, Alexander rebuilt it about twenty stadia from its ancient site. Strabo, however, attributes its re-establishment to Antigonus and Lyfimachus, without mentioning Alexander. Nor does Arrian, in his history of this province, take notice of this circumstance. Hence it is natural to conclude, that Alexander only formed a design of rebuilding it, or that he partially executed his project; that it was continued by Antigonus, and completed by Lyfimachus. This town was destroyed by an earthquake A.D. 180, according to Eusebius, but according to Dion Cassius, two or three years sooner. The Chronicon Pascale dates it A.D. 178. Marcus Aurelius re-established it. The river Meles ran by its walls, and near its source was another, where it has been said that Homer wrote his poems. Hence it was that Tibullus (l. iv. c. 1.) called these poems "Meletere Carmen," but Smyrna arrogates to itself the honour of having given birth to Homer. At Smyrna there was a quadrangular portico, with a temple of Homer and his statue. The Smyrnæans had also a bronze coin, which they called "Homerium." This town was built partly on the brow of a hill and partly on a plain; and towards its front and the gymnasium was the temple of the Mother of the Gods. The streets were paved, and intersected one another at right angles. It had several grand porticoes of a square form, ranges of buildings, and a fine library. In process of time Smyrna became the centre of the commerce of Asia. Luxury drew hither the arts; and it was decorated by superb edifices, and crowded by a multitude of strangers. At Smyrna there were none of those tyrants who oppressed many other cities of Asia, and even the Romans respected the happy state of this town, and left it the shadow of liberty. This city has retained a very considerable degree of its ancient celebrity. See the next article.

SMYRNA, or *Ismir*, in *Geography*, a city and sea-port of Asiatic

Asiatic Turkey, in the province of Natolia, situated on a gulf of the Mediterranean, which is capable of containing the largest navy in the world. On account of the extent and convenience of its harbour, it is become the common rendezvous of merchants from the four parts of the world, and the staple of their commerce; so that it is the first port for trade in the Turkish dominions. Its situation is delightful; and approaching it by sea, it has the appearance of a capacious amphitheatre, crowned at the summits with the ruins of an ancient castle. The bay is extensive, the anchorage excellent, and the water so deep, that ships of considerable burden may anchor close by the wharf. Many English merchants reside here, and they have a consul to protect them. The trade is conducted by Jew brokers, who are wealthy, and live handsomely and even splendidly. The whole town is a continual bazar, or fair, abounding with every thing that serves for clothing, sustenance, and pleasure; all the best commodities of Europe and Asia being brought hither for sale.

The adjacent territory is very fertile, abounding with fine olive-trees and vines; and it affords excellent wine. The European consul lives here in great state and magnificence. The population of Smyrna consists of about 130,000 persons: of these, about 70,000 are Turks, 30,000 Greeks, 15,000 Armenians, 10,000 Jews, and 5000 strangers and Franks. The governor is appointed by the Porte, who manages the civil concerns in the city; but in all criminal cases is subject to the mollah or cadi, who is judge of his district. The salary of the governor, or muselim, is estimated at nearly 300,000 piastres, or about 17,000*l.* sterling.

In the environs are several fine villages, to which the Franks and wealthy inhabitants resort in summer, particularly Bournabat, at the distance of about half an hour's ride, standing on the banks of the Melica, and at the foot of several mountains. Other villages are Cucklueiah, where the imperial consul has a palace; Bugiah, where the British consul has a good house; and Sadig, where the Dutch consul resides.

The total value of goods from Smyrna to London amounted, on an average of the years 1785, 1786, and 1787, to 463,349*l.* sterling, and from London to Smyrna to 423,548*l.* In 1790, 1791, and 1792, the exports to London amounted to 779,610*l.*, and the imports from thence to 848,240*l.* This city suffered very much by a fire on the 6th of August, 1763, which destroyed many of the best houses, factories, and magazines, and occasioned very extensive desolation. The loss sustained was reckoned at 200,000*l.* sterling; 176 miles S.S.W. of Constantinople. N. lat. 38° 28'. E. long. 27° 8'.

SMYRNA, a post-township of America, in the state of New York, and county of Chenango; 105 miles W. of Albany, bounded N. by Lebanon in Madison county, E. by Sherburne, S. by Plymouth, and W. by German. It is six miles square, and its streams supply grain-mills, saw-mills, and a fulling-mill. It has also a small furnace for casting of iron. Its vallies are rich and productive, and a great part of the hilly land is either arable, fit for meadow, or good for grazing. Hemp is cultivated on the rich mould of the vallies, and the timber is principally maple, beech, elm, bals-wood, and hemlock. The first settler here was Porter, in 1792, and a post-office was established in 1808. The whole population, in 1810, consisted of 1344 persons.

SMYRNA, *New*, a town of East Florida, inhabited by a colony of Greeks and Minorquins, established by Dr. Turnbull, on a branch of the Mosquito river. N. lat. 28°.

SMYRNIUM, in *Botany*, indubitably the *σμυρνιον* of Dioscorides, whose ample description is peculiarly appli-

cable to one of the species, *S. perfoliatum*. By his account of the sensible qualities of the seed, being so like Myrrh, the origin of the name from *σμυρρα*, *myrrh*, is sufficiently apparent.—Linn. Gen. 144. Schreb. 194. Willd. Sp. Pl. v. 1. 1467. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 328. Prodr. Fl. Græc. Sibth. v. 1. 202. Ait. Hort. Kew. v. 2. 157. Pursh v. 1. 196. Juss. 219. Tourn. t. 168. Lamarek Illustr. t. 204. Gærtn. t. 22.—Class and order, *Pentandria Digynia*. Nat. Ord. *Umbellatæ*.

Gen. Ch. *General umbel* unequal, increasing daily in size; *partial erect*. *General* as well as *partial involucrem* wanting. *Perianth* scarcely discernible. *Cor. Universal* uniform; the flowers of the disk abortive; *partial* of five lanceolate, keeled, slightly inflexed petals. *Stam.* Filaments five, simple, the length of the corolla; anthers simple. *Pist.* Germen inferior, styles two, simple; stigmas two, simple. *Peric.* Fruit oblong, striated, separable into two parts. *Seeds* two, crescent-shaped, convex on the outer side, and marked with three angles; flat on the other.

Ess. Ch. *Involucrem* neither general nor partial. Fruit oblong, with angular ribs. Petals pointed, keeled, incurved.

1. *S. perfoliatum*. Perfoliate Alexanders. Linn. Sp. Pl. 376. Willd. n. 1. Ait. n. 1. Sm. Fl. Græc. Sibth. t. 289, unpublished. (*S. creticum*; Matth. Valgr. v. 2. 131. Ger. Em. 1024. An Hippocelinum; Column. Ecphr. v. 2. 21.)—Stem-leaves simple, clasping the stem with their heart-shaped base, all serrated and alternate.—Native of Italy and the Levant. Common in the hilly parts of Greece, as well as in Crete and Cyprus. *Sibthorp*. A hardy biennial plant, one of the handsomest of its tribe, naturalized, in a manner, on rock-work, neglected banks, or open borders, in Chelsea garden, flowering in May. This answers most precisely to the *σμυρριον* of Dioscorides, inasmuch that we can only wonder at the doubts of any of his commentators. “*Παραφυρδας εχουσα πολλας*,” surely alludes to the abundance of very peculiar leaves surrounding the stem, which are contrasted, in the next sentence, with the broader foliage, springing from the root. That expression, therefore, is improperly rendered by the word *folioles*, offsets or seyons, of which there are no traces. The root is brown, fleshy, tuberous, with thick fibres. Stem two feet high, much branched, with dilated membranous angles, especially in the branches. *Radical leaves* stalked, twice or thrice ternate; their leaflets stalked, smooth, shining, ovate or wedge-shaped, notched, three-cleft, or variously lobed; *stem-leaves* sessile, simple, roundish-heart-shaped, crenate, smooth, reticulated with veins, either mere or less obtuse, or acute and elongated, embracing the stem with their broad, rounded base, one of whose lobes folds over the other; their colour becomes a rich golden yellow as the *flowers* advance toward perfection; the upper ones are gradually smaller, more coloured, and closer together. *Umbels* yellow, of many rays. *Seeds* black, globose, angular, scarcely ribbed, about the size of cabbage seed, of a hot, pungent, aromatic flavour, like the rest of the plant. The *petals* are really heart-shaped, with inflexed points.

2. *S. ægyptiacum*. Egyptian Alexanders. Linn. Sp. Pl. 376. Amoen. Acad. v. 4. 270. Willd. n. 2.—Floral leaves opposite, heart-shaped, entire.—Gathered in Egypt by Hasselquist. Of this there is no figure. By the Linnaean specimen, which consists of the top of the plant only, it appears nearly akin to the preceding; but differs essentially in having the *branches* opposite, or three together, not alternate, the *floral leaves* being also disposed in the same manner, and nearly, if not absolutely, entire.

SMYRNIUM.

3. *S. laterale*. Cape Alexanders. Thunb. Prodr. 51. Willd. n. 3.—Stem-leaves ternate, cut and serrated. Umbels lateral, sessile.—Gathered by Thunberg, at the Cape of Good Hope.

4. *S. Olusatrum*. Common Alexanders. Linn. Sp. Pl. 376. Willd. n. 4. Fl. Brit. n. 1. Engl. Bot. t. 230. (Smyrniac; Matth. Valgr. v. 2. 130. Hippofelinum; Ger. Em. 1019. Petroselinon Alexandrinum; Trag. Hist. 436.)—Stem-leaves ternate, stalked, serrated. Umbels terminal.—Native of rocks near the sea, the borders of marshes, or the neighbourhood of ancient buildings, in Britain, France, Spain, Holland, Cyprus, Greece, and Asia Minor, flowering in spring. The root is fleshy, usually biennial, but we have observed it to live several years in a situation where it could not produce flowers. Whole plant smooth, light green, shining, bushy, three feet high, of an aromatic and sweetish flavour. Stem round, pale, furrowed, hollow. Lower leaves thrice ternate, with broad, deeply serrated, variously shaped leaflets, ovate or wedge-shaped at the base. Footstalks dilated, concave, ribbed, and membranous. Umbels numerous, greenish-white, globose, of many general and partial rays; very rarely accompanied by a few small, awl-shaped leaves of a general involucre, but this is accidental, and occurs now and then in other genera that, like this plant, have never any partial involucre. The fruit is black, composed of two aromatic, acrid, bitter, three-ribbed seeds, as big as those of the garden *Tropaeolum*, or Nasturtium. There can be no more doubt of this being the *σμυρνιεύου* of Dioscorides, than there is respecting his synonym for our first species. The old name of *Olus atrum*, or Black Pot-herb, probably alludes to the colour of the seeds, which are remarkably large and conspicuous. Our English one was perhaps introduced from Germany, where, as well as in Italy, Ray says the plant is called *Herba Alexandrina*. Were it not for this information, we might suspect Alexanders, or Alifanders, (as the word sometimes is written,) to be a corruption of *Olusatrum* pronounced with a broad foreign twang. The root and young herbage formerly served those purposes in salads and broths, which are now better answered by the more delicately flavoured Celery.

5. *S. apiifolium*. Smallage-leaved Alexanders. Willd. n. 5. Ait. n. 3. (*S. creticum*, paludapii folio; Tourn. Cor. 22.)—"Stem-leaves wedge-shaped, obtuse, three-cleft, toothed."—Gathered in Crete, by Tournefort, from one of whose specimens, consisting of a branch with umbels in seed, Willdenow adopted this species. He informs us there was no general or partial involucre. We have seen nothing answering to the above account.

6. *S. cordatum*. Heart-leaved Alexanders. Walt. Carolin. 114. Pursh n. 1. (*Thapsia trifoliata*; Linn. Sp. Pl. 366. Willd. Sp. Pl. v. 1. 1465. Ait. Hort. Kew. v. 2. 156. *Sium folio infimo cordato, caulinis ternatis, omnibus crenatis*; Gron. Virg. 43.)—Radical leaves roundish-heart-shaped, crenate, simple; those of the stem ternate, stalked, acute, serrated. Ribs of the seeds prominent, compressed.—In woods, frequently on the mountains, from New England to Carolina, flowering in June and July. Root perennial. Flowers yellow. Pursh. The habit of the whole plant, and, if we mistake not, the character of the seeds, both agree with the present genus, but not at all with *Thapsia*; yet it is to be wished that Walter, in transferring this species hither, had not needlessly changed the specific name. The herb is smooth, slender, erect, slightly branched. Leaves light-green; the radical ones simple, shaped like those of a violet, on long stalks; the rest ternate, more ovate and acute. Umbels

small, dense, terminal, solitary. Walter says the flowers are white; and so they appear rather than yellow, in Kalm's specimen. The seeds are small, oval, brown, with three prominent, rounded, thick-edged, flat ribs to each.

7. *S. aureum*. Golden Alexanders. Linn. Sp. Pl. 377. Willd. n. 6. Ait. n. 4. (*Angelica acadensis*, flore luteo; Dodart Mem. ed. Amsterd. 557. t. 1.)—Leaves twice ternate; the middle division often pinnate; leaflets ovato-lanceolate, strongly serrated. Seeds elliptical, furrowed.—On the mountains and hills, near banks of rivers, from Pennsylvania to Carolina, flowering in June and July. Pursh. Root perennial, black, tufted. Stems numerous, erect, hollow, a foot and a half high, angular, furrowed, smooth like every other part of the plant, except at the origin of the footstalks. Lower leaves on long stalks, spreading; their leaflets an inch or more in length, coarsely serrated, acute, but not pointed. Umbels small, dense, yellow. Seed brown, not unlike Caraway seeds. The whole plant is said by Dodart to be acrid, bitter, and aromatic, "very different in flavour from common *Angelica*." We have, from the Rev. Dr. Muhlenberg, a variety of this, with much narrower, sharper, more finely serrated leaflets.

8. *S. acuminatum*. Pointed-leaved Alexanders. (*S. aureum* β; Linn. Sp. Pl. 377. Willd. n. 6. *S. foliis caulinis decompositis acuminatis*; Gron. Virg. 44.)—Leaves twice ternate; the middle division pinnate; leaflets ovate, taper-pointed, copiously and sharply serrated. Rays of the umbel elongated.—Native of Virginia; sent by Gronovius to Linnæus, who confounded it improperly with the last. The whole plant appears to be much larger. Stalks of the radical leaves at least a foot long; leaflets two inches or more in length, with very numerous, close, acute, rather unequal serratures, and taper points; stem-leaves smaller, less compound. Umbels solitary, on long terminal stalks; the general rays above an inch long, while in flower, accompanied, in our solitary specimen, with a serrated accessory leaf, which cannot be supposed a general involucre, though a few of the partial umbels are each also furnished with a single entire lanceolate leaf, more indicative of a partial involucre. The flowers seem to be yellow. We have no knowledge of the seeds, and the genus of this plant must therefore remain doubtful.

9. *S. atropurpureum*. Dark-purple-flowered Alexanders. Lamarck Dict. v. 3. 667. Pursh n. 3.—"Leaves all ternate; leaflets ovate, acute, serrated."—On dry slate hills in Virginia and Carolina, flowering from May to July. Pursh. Root perennial. Stem a foot or more in height, slightly branched, angular, smooth. Leaflets ovate, more or less elongated, pointed, smooth, rather fleshy, finely and regularly serrated, and somewhat cartilaginous at the edges, green on both sides. Umbels small, terminal, stalked, of a very dark purple; the partial ones having sometimes a very short involucre. Desfrouseaux (in Lamarck).

10. *S. integerrimum*. Entire-leaved Virginian Alexanders. Linn. Sp. Pl. 377. Willd. n. 7. Ait. n. 5. Pursh n. 4.—Leaves glaucous, twice or thrice ternate; leaflets oval, entire. Rays of the umbel elongated. Central flowers abortive. Seeds ovate, angular.—On dry hills, from New England to Carolina, but scarce; flowering in June. Root perennial. Pursh. The whole plant is smooth; and glaucous in some degree. Stem round, somewhat branched, leafy. Leaflets about an inch long. Common footstalk of the stem-leaves concave, dilated, membranous; partial ones long and slender. Umbels without any general or partial involucre; the general rays long and slender; partial ones short. Flowers yellowish; the central ones male,

male, or abortive. *Fruit* the size of mustard-seed, blackish, obscurely angular in Kaln's dried specimen, agreeing much with some kinds of *Ligusticum*, to which genus this plant is closely allied in habit; see *LIGUSTICUM*. The *seeds* of these genera are, in some cases, nearly akin; which circumstance has led a learned botanical traveller, Marschall von Bieberstein, to name a plant of mount Caucasus *Smyrniium nudicaule*, which is no other than *Ligusticum cornubiense*, according to a specimen from Dr. Fischer. This is the more surprising, as the same able botanist had previously described *Danaa* of Allioni, which is the very same species, for a *Pimpinella*. See Sims and König's Ann. of Bot. v. 2. 433. The presence of a general and partial involucre, and especially the small, not capitate, *stigmas*, prove it, nevertheless, to be no *Pimpinella*; nor do the *seeds* themselves answer to that genus.

11. *S. nudicaule*. Naked-stalked Alexanders. Pursh n. 5.—“Leaves radical, ternate; leaflets with a few unequal teeth. Flower-stalk radical. Rays of the umbel elongated, with scarcely any general or partial involucre.”—Gathered by governor Lewis, on the Columbia river, flowering in April and May. *Root* perennial. The natives eat the tops of this plant, and boil it in their soups, as we use celery. *Pursh*.

SMYRNIUM, in *Gardeining*, contains a plant of the herbaceous esculent kind, of which the species cultivated is the common alexanders (*S. olusatrum*).

Method of Culture.—These plants are raised from seeds, which should be sown in the spring, in any light soil and open situation, in shallow drills, fifteen or eighteen inches asunder; and when the plants are come up two or three inches high, be thinned out to six or eight inches distance in the rows, to give them room to shoot up strong; when earth must be drawn up about them gradually, in order to blanch or whiten them a little below, that they may be more crisp and tender for autumn and winter use; but as in the spring following they shoot out again vigorously, some earth should be hoed up close about each plant, and in three or four weeks they will be blanched fit for use.

This is used as a culinary plant, when blanched, in the same manner as celery, and is of a warm aromatic quality.

SMYRUS, in *Ichthyology*, a name sometimes given by Pliny to the fish called by authors *myrus*, the *Muraena myrus* of Linnæus, and by Willughby the *sea-serpent*, with a compressed tail.

It is a species of the *muraena* according to Artedi, and is distinguished from all the others by that author, under the name of the *muraena* with a sharp snout, variegated with white spots, and with the edge of the back-fin black.

SMYTHAM, in *Mineralogy*, lead-ore stamped and pounded down, like powder or sand, to cleanse the stones and earth from the ore.

SNAASEN, in *Geography*, a lake of Norway, in the province of Drontheim, 24 miles long and three wide; 54 miles N.N.E. of Drontheim.

SNACKENBURG, a town of Westphalia, in the principality of Lunenburg-Zelle; 52 miles E.S.E. of Lunenburg.

SNÆFELL'S SYSSEL, a district of Iceland, about six miles to the west of Miklaholt, which is a village situated on a small eminence, completely surrounded by morasses, and consists of a church, the priest's house, and a few cottages. This Syffel forms the extremity of the peninsula, terminated by the Snæfell Jökul. The central part of this peninsula, through its whole length, is occupied by a lofty range of mountains, between which and the sea, on the

southern side, an extensive tract of flat land intervenes. Beyond Miklaholt, this plain narrows considerably, becoming not more than three or four miles in width. Some part of this extent is sandy, and appears to have been left by the sea. The greatest part, however, is boggy; and the whole is covered with an abundance of fine grass, on which numbers of cattle and sheep are seen grazing. Here and there are small elevations. See *STADERSTAD*.

The height of Snæfell Jökul was ascertained by calculation to be 4558 feet; which estimate differs no more than a few feet from the measurement of the Danish officers, who at this time (1810) were employed in surveying the coasts of Iceland. Nevertheless, Eghert Olafsoo, one of the most eminent naturalists in modern times, asserts that, by barometrical measurement, he found the height of this mountain to be not less than 7000 feet; a calculation that certainly differs widely from the truth. This mountain is volcanic, as part of it has discharged lava, which has flowed into the sea; but this lava is very ancient; as no eruptions have taken place, either from the Snæfell Jökul, or from any part of the adjacent mountains, since the island first became inhabited. This mountain was ascended by the travellers whose report we are now citing, and they have described the progress of their ascent, which was a very adventurous undertaking, on account of the chasms and precipices occasioned by the snow that covers the summit and sides of it.

Snæfell Syffel is situated on the western coast (see *SYSSEL*), and contains 270 farms, 652 families, and 3541 inhabitants. Mackenzie's Travels in Iceland.

SNAFELSNESS, a promontory on the west coast of Iceland, 45 miles long, and five broad.

SNAFFEN, a town of Norway, in the province of Drontheim; 46 miles N.E. of Drontheim.

SNAPPLE, in the *Manege*, a well-known kind of bridle. The snaffle, after the English fashion, is a very slender bit-mouth, without any branches; they are much used in England instead of true bridles, which are only employed in the service of war. The French call them *bridoas*, by way of distinction from *brides*, i. e. *bridles*.

The snaffle, or small watering-bit, is commonly a scatch-mouth, accoutred with two little very straight branches, and a curb, and mounted with a head-stall, and two long reins of Hungary leather. See *BRIDLE*.

The snaffle is much recommended by Mr. Berenger in his History and Art of Horsemanship, vol. ii. p. 225, &c.

SNAFIELD, in *Geography*, the highest mountain in the Isle of Man; its height, observed by an exact barometer, the mercury of which subsided 2 $\frac{1}{2}$ inches, being about 580 yards. The summit of this mountain affords a prospect of England, Scotland, Ireland, and Wales.

SNAG-GREET. See *SNAIL-COD*.

SNAIL, in *Ichthyology*. See *LIPARIS Nestras*.

SNAIL, *Helix*, in *Natural History*. See *HELIX*.

The *gardea snail*, or *helix lucorum* of Pultney, is a well-known species: it abounds with a viscid slimy juice, which it readily gives out by boiling to milk or water, so as to render them thick and glutinous. The decoctions in milk are apparently very nutritious and demulcent, and have been recommended in a thin acrimonious state of the humours, in consumptive cases and emaciations. See *HELIX Hortensis*.

The *exotic snail*, or *pomatia helix* of Linnæus, is also celebrated on account of its naturalization in this country, by sir Kenelm Digby, and its use, as a food, in several parts of Europe during Lent. See *POMATIA* and *HELIX Pomatia*.

Perrault doubts of snails having eyes, and Dr. Brown denies it;

it; but according to Dr. Porterfield, a good microscope shews them distinctly.

The eyes of snails are lodged in their horns, one at the end of each horn, which they can retract at pleasure. Med. Ess. Edin. vol. iii. art. 12.

The manner of examining these eyes, which are four in number, is this; when the horns are out, cut off nimbly the extremity of one of them, and placing it before the microscope, you may discover the black spot at the end to be a really semiglobular eye.

The dissection of this animal is very curious; for by this means the microscope not only discovers the heart beating just against the round hole near the neck, which seems the place of respiration, but also the liver, spleen, stomach, and intestines, with the veins, arteries, mouth, and teeth, are plainly observable; the guts of this creature are green, from its eating of herbs, and are branched all over with fine capillary white veins; the mouth is like a hare's or rabbit's, with four or six needle-teeth, resembling those of leeches, and of a substance like horn.

Snails are said to couple three times at the distance of about fifteen days from each other, nature producing a new spear for each time of copulation, which lasts ten or twelve hours; at the end of about eighteen days they bring forth their eggs, by the aperture of their neck. Baker's Microscope, p. 217. Mem. Roy. Ac. Abr. vol. iii. p. 85.

So small an animal as the snail is not free from the plague of supporting other small animals on its body; and as in other animals we find these secondary ones either living only on their surface, as lice, &c. or only in the intestines, as worms; it is very remarkable that this creature infests the snail in both these manners, being found sometimes on the surface of its body; and sometimes within its intestines.

There is a part of the common garden snail, and of other of the like kinds, commonly called the *collar*; this surrounds the neck of the snail, and is considerably thick, being the only part that is visible when the animal is retired quietly into its shell. In this state of the animal, these insects, which infest it, are usually seen in considerable numbers, marching about very nimbly on this part: besides, the snail, every time it has occasion to open its anus, gives them a place by which to enter into its intestines, and they often seize the opportunity. Mem. Roy. Ac. Abr. vol. iii. p. 377, &c.

Snails are great destroyers of fruit in our gardens, especially the better sorts of wall-fruit. Lime and ashes sprinkled on the ground where they most resort, will drive them away, and destroy the young brood of them: it is a common practice to pull off the fruit they have bitten, but this should never be done, for they will eat no other till they have wholly eat up this, if it be left for them.

Aristotle and the old Greeks had no idea of the generation of these insects in the manner of other animals, but supposed them produced spontaneously; but the Romans shew, by many passages in their writings, that they have got over this error; and even seem, by the preference they gave to the neck of this animal in this intention, to have understood the hermaphrodite structure of this insect, which much later ages have pretended to make a new discovery.

The eastern nations at present run much into the opinions of the Romans of old, as to provocatives; they use, as the others did, every thing that serves to the purposes of generation in other animals, and every thing that has but the resemblance of the external figure of the parts subservient to it.

SNAIL, *Ear*. See SHELLS.

SNAIL, *Naked, Limax*. See SLUG and LIMAX.

SNAIL, *Oat*, a name given by Dr. Litter, in the Philosophical Transactions, to a small snail, which he observed under the loose bark of old willows, elms, and other trees, and which is of a very singular structure; the shell resembling an oat-corn, whence the name, and its volutæ, or wreaths, running contrary to the direction of them in other snails, that is, east and west, as the philosophers express it, referring it to the motion of the sun; but these shells, to use that language, have the turns west and east, or more plainly, they have the turns running from the right hand to the left, not from the left to the right, as other snails. Phil. Trans. N^o 250.

SNAIL is also the name of the animal inhabiting many kinds of shells, as the patella, cochlea, nerite, buccinum, turbo, trochus, voluta, murex, purpura, lyra, and concha Veneris. See PATELLA, COCHLEA, &c.

SNAIL-*Cod*, in *Agriculture*, a name given by Mr. Worlidge to a species of manure found at the bottom of deep rivers. It is a kind of mud or sludge, very soft, full of wrinkles, and intermixed with many little shells and snails, to which it is thought to owe a great part of its richness. It is sometimes called *snag-greet*.

SNAIL-*Flower*, in *Botany*. See PHASEOLUS.

SNAIL-*Horned*, in *Rural Economy*, a term applied to the horns of such cattle as have them short and down-hanging, with blunt points, and somewhat bent, in the common form of the snail.

SNAIL-*Shell, Medic or Trefoil*, in *Agriculture*, a plant of the artificial grass kind, often known by the name of heart clover or trefoil. It was introduced into Berkshire, according to the agricultural report of that district, by captain Vancouver, on his return from his voyage round the world, though a native of that country, under the notion of the seeds being those of some more important plant from the South Sea islands. It has since been cultivated there, it is said, with success, producing a luxuriant herbage, of which cattle are extremely fond. It stands the winter well, and a crop may at any time be produced. It is asserted to have the advantage of lucerne, in not being easily choaked, and in growing on a light soil, though it without doubt produces the most abundantly in good soils. The cultivators have hitherto sown it in the broad-cast method, and are, it is said, determined to persevere, having now collected a sufficient quantity of its seed to enable them to extend their trials to some acres of land.

It would seem to be deserving of trials in other counties, where herbage is scarce and not easily raised.

SNAIL-*Trefoil*, in *Botany*. See MEDICAGO.

SNATH, in *Geography*, a market-town in a parish of the same name, lower division of the wapentake of Osgoldcross, liberty of the honor of Pontefract, and West Riding of Yorkshire, England, is situated at the distance of 22 miles S. by E. from York, and 174 miles N. by W. from London. The site of this town is a gentle eminence, which rises from the southern bank of the river Aire, and overlooks a flat and fertile district of country. The market-day here is Thursday, weekly; and there are fairs on the first Friday in April, 10th of August, and first Friday in September, for horned cattle, sheep, woollen cloth, linen, and cheese. The church is an ancient building, in the pointed style; remarkable only as the burial-place of the ancestors of lord viscount Down, who has a seat at Cowick, about a mile S.E. from Snath. Carlton, two miles to the N.E., is the seat of the family of Stapleton, whose ancestors distinguished

guished themselves by their bravery and loyalty during the civil wars between king Charles I. and his parliament.

According to the parliamentary returns of 1811, Snaith parish includes eleven townships, viz. Armin, Baln, Cowick, Goole, Hick, Henfall, Hooke, Follington, Rawcliff, and Snaith, which united contain 1133 houses, and 5095 inhabitants, of whom about 743 reside in the town of Snaith. Beauties of England and Wales, vol. xvi. by John Bigland, 8vo. 1812. Carlisle's Topographical Dictionary of England, 4to. 1808.

SNAKE, ANGUIS, in the Linnæan *System of Zoology*, is a genus of serpents, the characters of which are, that the animals belonging to this genus have abdominal and sub-caudal scales. Here we may observe, that Linnæus has distinguished the small scales, with which the back and sides of the animals belonging to the class of serpents are covered, by the name of *squamæ*; and the oblong, narrow, transverse plates, with which the bellies of some of them are covered, by the denomination of *scuta*. Those that have both *squamæ* and *scuta*, he distributes under the genus of *coluber*; those that have only *squamæ*, under the appellation of *anguis*. In conformity to this distribution, he has ranked the common snake, as well as the viper, &c. under the genus of *coluber* (which see); and classed sixteen different species, as the four-footed Javan snake, the common slow-worm, &c. under that of *anguis*. See SERPENTES.

SNAKE, Annulated. See AMPHISBÆNA and SERPENTES.

SNAKE, Argus. See COLUBER *Argus*.

SNAKE, Australasian. See COLUBER *Australasia*.

SNAKE, Black. See COLUBER *Constrictor*.

SNAKE, Black and Red. See COLUBER *Torquatus*.

SNAKE, Blood, Hamorrhous, the name of a peculiar species of serpent, so called, because it was supposed, that on a person's being bit by it, the blood flowed out of every part of the body.

It is a small serpent, seldom arriving to more than a foot long; its eyes are remarkably vivid, bright, and sparkling; its skin is very glossy, and its back variegated with a great number of black and white spots; its neck is very slender; its tail extremely sharp, and it has a sort of small horns placed over its eyes. It is found in Egypt.

There is also an American kind of this, found in the southern parts, and called by the natives *abucyalli*, which is larger than the other, and resembles the rattle-snake in many particulars, but wants the distinguishing character in the tail.

SNAKE, Boaform. See COLUBER *Boaformis*.

SNAKE, Brazilian. See COLUBER.

SNAKE, Bull-headed. See COLUBER *Bucephalus*.

SNAKE, Coach-whip. See COLUBER *Flagellum*.

SNAKE, Common, or Ringed, Coluber Natrix of Linnæus. See NATRIX and COLUBER *Natrix*.

The following account of an easy method of preserving snakes may not be unacceptable. When the snake is killed, it must be washed clean, and put into a glass of a proper size, the tail first, and afterwards the rest of the body, winding it in spiral ascending circles, and disposing the back, which is always the most beautiful, outwardly. A thread connected with a small bead is then, by a needle, to be passed through the upper jaw from within outwardly, and then through the cork of the bottle, where it must be fastened: by this means the head will be drawn into a natural posture, and the mouth kept open by the bead, by which the teeth, &c. will be discovered. The glass is then to be filled with rum, and the cork sealed down. In this manner the snake may be preserved for many years; nor will the spirits impair or change the lustre of its colour.

SNAKE, Daboya. See COLUBER.

SNAKE, Hooded. See COLUBER *Naja*.

SNAKE, Horned. See CERASTES and COLUBER *Cerastes*.

SNAKE, Javan. See COLUBER *Javanicus*.

SNAKE, Oak. See DRYINAS and CROTALUS.

SNAKE, Panther. See COLUBER.

SNAKE, Rattle, a very dreadful genus of serpents. See CROTALUS.

SNAKE, Ruffelian. See COLUBER *Ruffelli*.

SNAKE, Sand, the English name of a kind of serpent found in Lybia, and some parts of Italy. See AMMO-DYTES.

SNAKE, Sea, Serpens Marinus, the name of a fish of the eel-kind, being the cylindric *muræna* (which see), with the tail naked and acute, usually of five or six feet in length, and a furrowed body, continuing all the way of the same thickness, till near the tail. Its back is of a dusky yellow, and its belly a shining blue; its snout is long, slender, and pointed, and the opening of its mouth extremely large; near the end of the under jaw it has four or five large sharp teeth, which bend backwards; the rest of the teeth are very small, and stand close together; at the very extremity of the upper jaw it has four very large teeth, and all the rest are small, and like those in the under one; but the largest teeth of all are placed in a row, in the middle of the palate; it has only one pair of fins, which are placed near the gills; the opening of the gills is at a considerable distance from the head, and it is marked with dotted lines down its sides. It is common in the Mediterranean, and its flesh is very fine tailed, but full of small bones. Willughby, Hist. Pisc. p. 108.

Bishop Pontopiddan mentions (in his Hist. of Norway, vol. ii. p. 195, &c.) a sea-snake of a very prodigious size; for the particulars of its dimensions, &c. we must refer to the testimonies which he has recorded. These animals, some of which are said to be no less than six hundred feet long, are dangerous to navigators, as they throw themselves over vessels of some hundred tons burthen, and sink them to the bottom by their weight. The preservative against them is castor, the smell of which they are said to avoid. The bishop apprehends, that this creature, which inhabits the North sea, is the leviathan mentioned in the scripture. Isaiah, xxvii. 1. Job, xxvi. 13.

SNAKE, Sleep. See HYPNOTICUS *Serpens*.

SNAKE, Spectacle. See COBRAS *de Capello* and COLUBER.

SNAKE, Triangular-headed. See COLUBER.

SNAKE-Gourd, in Botany. See TRICOSANTHES.

SNAKE-Root, Serpentaria, the root of a species of aristolochia. See ARISTOLOCHIA *Serpentaria*.

The ancients were only acquainted with two kinds of serpentaria, the great and the small: but since the discovery of America, botanists have added several others; as the serpentaria Virginiana, or Virginian snake-root; besides that of Canada, and that of Brasil.

They were supposed to be alexipharmics, or counter-poisons; and as such were ingredients in the Venice treacle.

The herb dragon is also called, by some writers, the great serpentaria; by the ancients, *draunculus major*. This has its stem very straight, smooth, and marked with red spots, like the skin of a serpent; whence, probably, as much as from its virtues, it is that it takes its name. Its root is big, round, and white, covered with a thin skin. The smaller serpentaria, of this kind, has its stalk much like that of the larger, only its leaves are like those of ivy, whereas those of the larger are digitated, after the manner of bastard hellebore. Its root is round and bulbous.

The serpentaria of Virginia, called also colubrina Virginiana, asarum Virginianum, serpentaria nigra, and the contrayerva of Virginia, has its leaves green and large, almost in figure of a heart; its fruit round, and its root, which is of a very strong aromatic smell, has, at bottom, an infinite number of long small filaments, representing a kind of beard, of a brownish colour on the outside, and paler or yellowish within.

It was first brought into Europe from Virginia by the English; and is by the Americans esteemed a sovereign antidote against the bite of the rattle-snake.

We are told by travellers, that this root not only cures the bite of a rattle-snake, but that that animal flies the very smell of it; for which reason the Indians, and other travellers, always carry it with them on the end of a staff, by way of a preservative from that creature.

The dried serpentaria root is imported into this country in bales, each containing from two to five hundred weight. The dried root has an aromatic odour, not unlike that of valerian; and a sharp, warm, bitter taste, resembling in some degree that of camphor. Water extracts all the sensible qualities of the root, affording a yellowish-brown infusion, which is not altered by sulphate of iron or zinc, the nitrate of silver, oxymuriate of mercury, tartarized antimony, the mineral acids, and the alkalies; nor is it precipitated by gelatine or tannin. The superacetate of lead throws down a flocculent precipitate, which is not soluble in acetic acid, shewing the presence of mucus. With alcohol it affords a bright greenish tincture, which is rendered turbid by the addition of water. The active principles of serpentaria, therefore, appear to reside in a bitter resin; and perhaps camphor, and essential oil.

For medical purposes, serpentaria, or Virginian snake-root, is reckoned a stimulating diaphoretic and tonic. It is beneficially employed in typhoid and putrid fevers, whether idiopathic, or accompanying the exanthemata, to excite diaphoresis, and support the powers of the system; and is found frequently to increase the efficacy of cinchona in removing protracted intermittents. It is also an excellent remedy in dyspepsia, particularly when the skin is dry and parched; and is sometimes used as a gargle in putrid sore-throat. On account of its stimulant properties, it is contraindicated when the inflammatory diathesis is present; and previous to its exhibition, the bowels should be well evacuated.

It may be given in substance, or in infusion made by macerating ziv of the bruised root in $\text{f}\text{z}\text{xij}$ of boiling water, in a covered vessel for two hours, and straining. Decoction is a bad form of giving serpentaria, as the boiling dissipates the essential oil, on which the virtues of the remedy chiefly depend. The dose of the powdered root is grs. x , or grs. xx , increased to zss ; that of the infusion $\text{f}\text{z}\text{ss}$ to $\text{f}\text{z}\text{ij}$, every fourth hour.

The official preparations are as follow: viz. the "tinctura serpentariæ," the "tinctura cinchonæ composita," and the "electuarium opiatum." The "tincture of snake-root" of the Lond. and Dub. pharmacopœias is prepared by macerating for fourteen days (seven days, Dub.) three ounces of snake-root (cut and bruised, Dub.) in two pints of proof spirit, and filtering. The "tinctura arilolochiæ serpentariæ," or "tincture of snake-root," of the Edinb. Ph., is obtained by digesting for seven days two ounces of snake-root bruised, a drachm of cochineal in powder, in two pounds and a half of proof spirit, and filtering through paper. This tincture is an useful addition to infusion of cinchona in typhoid and putrid fevers, gout, and periodic head-ache. The dose is from $\text{f}\text{z}\text{ss}$ to $\text{f}\text{z}\text{ij}$; or when taken

in water, as much as can be taken without any injury from the operation of the spirit.

The "tinctura cinchonæ composita," or "compound tincture of cinchona," of the Lond. and Dub. Ph., is prepared by taking of lance-leaved cinchona bark, powdered, two ounces; dried orange-peel, an ounce and a half (half an ounce, Dub.); Virginian snake-root bruised, three drachms; saffron, one drachm; cochineal in powder, two scruples; macerating for fourteen days in twenty fluid-ounces of proof spirit, and filtering. This tincture is more grateful than the official tincture of cinchona, and though it contains less cinchona, yet the addition of the other ingredients renders it more useful both as a stomachic and a febrifuge. It is the same as the celebrated tincture of Huxham, who generally gave it in intermittents and low nervous fevers, in diluted wine or any proper vehicle, with ten or fifteen drops of elixir of vitriol (aromatic sulphuric acid, Edinb.) The dose is from fzj to $\text{f}\text{z}\text{ij}$, or more, in intermittents. For an account of the "electuarium opiatum," see OPIUM. Thomson's Lond. Disp.

Snake-Root, Rattle. See POLYGALA Senega.

Snake-Root, Rattle, in the *Materia Medica*. See SENEGA.

Snake-Stone, in *Mineralogy*. See AMMONITE.

Snake-Weed Knot-Grass, in *Agriculture*, a common grass by way-fides, which, if cultivated, the seeds are found to answer the same purposes as those of buck-wheat. It is annual, or at most biennial, in its growth.

Snake-Wood, in the *Materia Medica*, is the wood or root of the tree which affords the nux vomica, or of other trees of the same genus. It is brought from the East Indies under the name of lignum colubrinum, in pieces about the thickness of a man's arm, covered with a rusty-coloured bark, internally of a yellow colour, with whitish streaks. This wood, in rasping or scraping, emits a faint but not disagreeable smell; and when chewed for some time, discovers a very bitter taste.

From the experiments of Cartheuser, water appears to be the proper menstruum of its active matter. It has been recommended, in small doses, not exceeding half a drachm, as an anthelmintic, and in obstinate quartans, jaundices, cachexies, and other chronic disorders. It is said to operate most commonly by sweat, sometimes by stool, and sometimes by vomit. It appears, however, to be possessed, in a lower degree, of the same ill qualities with the nux vomica. Lewis.

Snake Creek, in *Geography*, a river of Louisiana, on the north-east side of the Missouri, in N. lat. 38° , 18 yards wide.

Snake Islands, a cluster of small islands in the Indian sea, near the coast of Africa. S. lat. $5^{\circ} 20'$.

Snake Indians, a tribe of Indians in Louisiana, on the south-west side of the Missouri river, near the heads of the Arkansas, Platte, and Yellow-stone rivers. The number of warriors is 200, and of inhabitants 5500. They trade with New Mexico. These Indians, though a very numerous race, are badly armed, and much at the mercy of the other Indians, by whom they are made slaves, when taken prisoners. They are also called Ayuten bands, and Camanches. They wander about the heads of the Platte, and in the vast plains bordering on New Mexico and New Spain, south of the Arkansas; and are divided into many bands. One of these bands is probably that denominated Paunch Indians, who wander along the Rocky mountains, and sometimes venture across. The Snake Indians possess a very great number of horses, asses, and mules. Mr. Brackenridge, in his "Views of Louisiana," observes, that these Indians were different,

different, both in language and appearance, from any whom he had ever seen; and he thinks, that the found of the language bears a considerable resemblance to those of Africa which he had heard. We shall here subjoin a brief account of the river, near which these Indians are settled. The Arkansas, next to the Missouri, is the most considerable tributary of the Mississippi. It is nearly 2500 miles in length, and navigable at proper seasons through nearly the whole distance. The chief rivers which fall into it are the Verdigris, the Negracka, Canadian river, Grand river, &c. Several are much impregnated with salt, and the Arkansas, at certain seasons, is also brackish. The lands on this river, for 600 or 800 miles upwards, are described as very fine, and capable of affording settlements, though principally untimbered. There is a remarkable communication between the Arkansas and White river, by a channel connecting the two rivers, with a current setting alternately out of the one or the other, as the flood in either happens to predominate. The Platte is the longest and largest of the rivers which discharge themselves into the Missouri, being little short of 2000 miles, and yet it can hardly be reckoned a navigable stream; the channel being very wide, and the quicksands, with which it abounds, ever varying. Several fine navigable rivers, however, discharge themselves into it; such are the Elk Horn, the Wolf river, and the Padonca Fork.

The Yellow-stone, or Roche Jaune, much resembles the Missouri in extent and difficulty of navigation, and is a very considerable river. After the junction, the Missouri undergoes a very perceptible change. In seasons of high water, it is more properly a flood, and indeed the descriptions of its rapidity are almost incredible. It enters the Missouri 1880 miles up. Its principal branches are Big Horn, Tongue river, and Clark's river.

SNAKENBURG, a town of Brandenburg, in the Old Mark, on the Elbe; 10 miles N. of Sechaufen.

SNAKING, in the *Practice of Rigging*, a sort of fastening to confine the outer turns of seizings, &c. with the same size rope, line, spun-yarn, &c. by passing it across and under the outer turns at angles; so that one part may remain perfect and independent, if the other should be shot away.

SNAP-DRAGON, or *Calf's-Snout*, in *Botany*. See ANTIRRHINUM.

The least sort of this plant is sometimes a troublesome weed in corn-fields, but it is annual in its growth, and, of course, with care, easily and readily destroyed by preventing its flowering and producing seeds.

SNAP-DRAGON of *America*. See RUELLIA and BARLERIA.

SNAPE, in *Anchor-Making*, denotes the sudden diminution of any part.

SNAPPERTUNA, in *Geography*, a town of Sweden, in the province of Nyland; 7 miles E.N.E. of Eknas.

SNAP-TREE, in *Botany*. See JUSTICIA.

SNARES, in *Geography*, a cluster of craggy islands in the South Pacific ocean, discovered by Capt. Vancouver, on the 24th of November, 1791, and appearing without verdure. The north-eastermost, which is the largest, he apprehended to be equal in extent to all the rest; it is about 9 miles in circuit, and may be seen 8 or 9 leagues off. It is situated in S. lat. 48° 3'. E. long. 166° 20'. Mr. Broughton also discovered these islands on the 23d of the same month, and in passing through them, called the largest "Knight's Island;" which see.

SNARNVIER, a town of Asiatic Turkey, in the province of Sivas, anciently called "Synoria," and once the place where Mithridates kept his treasures; 25 miles S.S.W. of Arabkir.

SNATCH-BLOCKS, in *Block-Making*. See BLOCKS.

SNATHE, in *Agriculture*, a term applied to the handle of a scythe.

SNAYERS, PETER, in *Biography*, a painter of very considerable merit in almost every branch, but particularly in battles, huntings, and landscapes. He was born at Antwerp in 1593, and was a disciple of Henry van Balen. He was held in great estimation by the archduke Albert, who patronized him, appointed him his painter, and sent several of his pictures into Spain. Besides this superior encouragement, he was employed for many of the churches in the Netherlands, and his battle-pieces are to be found in all the most choice collections of that country. Rubens and Vandyck honoured them with their approbation; and the latter painted the portrait of Snayers among the eminent artists of the day. He died in 1670, aged 77.

SNEATH, or SNEYTH, in *Agriculture*, a term applied to the shaft of a scythe in some places.

SNECK, in *Rural Economy*, provincially the latch of a door or gate.

SNECKEN, in *Geography*, a town of Prussian Lithuania; 8 miles W.S.W. of Tilsit.

SNEECK, a town of Holland, in the province of Friesland, situated in the country of Westergoo, called by the natives "Snitz." The town is well-built, and encompassed by ditches and ramparts. Several learned men have been educated in the Latin school of this town; 38 miles W.S.W. of Groningen. N. lat. 53° 4'. E. long. 5° 35'.

SNEEZE-WORT, in *Botany*, a species of *Achillea*; which see.

SNEEZE-WORT, *Austrian*, a species of *Xeranthemum*; which see.

SNEEZING, in *Medicine*, *Sternutatio*, a violent convulsive motion of the muscles of respiration, which is preceded by a deep inspiration filling the lungs, then forces the air violently through the nose, while the lower jaw is at the same moment closed, and shakes the head and whole body. See LUNGS.

Sneezing is always excited by some irritation affecting the inner membrane of the nose; and the air, therefore, which in coughing is expelled through the mouth, is vehemently driven through the nostrils in sneezing, for the purpose of expelling that irritation. When a person is about to sneeze, he perceives a sort of gentle and agreeable tickling in the nose, and sometimes there is also a similar sensation about the præcordia: when one or both these are felt, the person is obliged to suspend all the bodily actions and wait the event; the whole effort of the body appears to be centered in the convulsion which ensues, and the expulsion of the air through the nostrils is accompanied by the peculiar noise so well known. In general, one or two of these convulsive efforts effects the purpose of removing the irritating cause; but cases are recorded, in which the repetition and violence of the convulsion have been increased to the extent of becoming a disease; and, in persons of an apoplectic disposition, it is even said to have induced that disease, and thus to have proved fatal. (See a case related by Morgagni, De Sed. et Caus. Morborum, Epist. xiv. art. 27.) It is clearly demonstrable, indeed, as Van Swieten has shewn, that continued paroxysms of sneezing tend to load the vessels of the head with blood: for the violent contraction of the chest impedes for the time the passage of the blood through the lungs, and therefore obstructs the return of the venous blood from the head, the vessels of which necessarily become distended. That this is actually the case is evident from the appearances; because, on a repetition of sneezing, the face swells and looks redder, the eyes water and appear full and distended,

distended, and the nose drops from the increased secretion into its cavities. (Van Swieten Comment. ad Aph. 271.) Its occasional dangerous violence is said to have been the cause of the benediction, so universally bestowed on those who sneeze, of which we shall say more presently.

The causes of sneezing are various, and consist not only of irritating matters immediately stimulating the lining membrane of the nose, but of sympathetic irritations from neighbouring, or even from distant parts. Any extraneous body brought into contact with the pituitary membrane, such as instruments, and especially irritating powders, such as snuff, or even its own mucous fluids, under particular states, will excite sneezing. As a direct communication exists between the eyes and the nostrils, into which the tears are constantly passing through the lacrymal ducts, a reverse sympathy is excited in many people by irritations of the eye, so that the membrane of the nose is at the same time titillated; whence, in such persons, sneezing is immediately excited by sudden exposure to a strong light, as by passing from a shade into a bright sun-shine, especially where that is strongly reflected from snow or a white pavement. Other sympathies have been mentioned by medical authors, especially irritations in the lungs, and also in the stomach and bowels, as the causes of sneezing. Thus it has been produced by carbonic acid gas, by fermenting beer, by eating shell-fish, by worms in the alimentary canal, by a leaden ball remaining in the region of the diaphragm, and even by more distant irritations, as by the distention of the gravid uterus in pregnancy, diseases of the head, &c. See Richter's Bibliotheca, vi. 730. See also Sauvages Nosol. Method. who makes seven species of *sternutatio* from these various causes.

It is only in these rare cases in which sneezing, being connected with some other disease, becomes the object of medical treatment; and then of course it can only be remedied by curing the disease, or removing the distant irritations, from which it originates. Like other spasmodic affections, however, it may be alleviated by opiates, with camphor and ether, and similar antispasmodics. It would be fruitless to mention many of the inert remedies that have been proposed; such as bags, filled with aromatic substances, fixed to the vertex, rubbing the gums, &c.

The custom of *bleffing* persons when they sneeze is derived from very ancient times, and its origin has been variously accounted for. Several writers affirm that it commenced in the year 750, under pope Gregory the Great, when a pestilence occurred, in which those who sneezed died; whence this pontiff appointed a form of prayer and a wish to be said to persons sneezing, for averting this fatality from them. But the custom is of much more ancient date. It was accounted very ancient in the time of Aristotle, who in his problems has endeavoured to account for it. It is alluded to in the Greek Anthology in an epigram, in which the salutation of *salve Jupiter, Ζευ σπρωμι*, is given as a familiar phrase addressed to sneezers. Pliny also questions "cur sternutantes salutantur?" (Nat. Hist. lib. 28. cap. 2. Anthol. Lips. 1794. tom. iii. p. 95.); and Cælius Rhodoginus has an example of it among the Greeks in the time of Cyrus the younger. In Alexander Ross's appendix to Arcana Microscopi, p. 222, it is said, "Prometheus was the first that wished well to the sneezer, when the man, which he had made of clay, fell into a fit of sternutation, upon the approach of that celestial fire which he stole from the sun. This gave original to that custom among the Gentiles, in saluting the sneezer. They used also to worship the head in sternutation, as being a divine part, and seat of the senses and cogitation." For many other passages relating to this subject, see Brand's Observations on Popular Antiquities,

edited by H. Ellis, vol. ii. p. 456, et seq. These testimonies are sufficient to shew the antiquity of this custom, and the obscurity of its origin. It may be added, that sneezing has been from ancient times also considered as an *omen*; respecting which Pliny has some observations in the chapter just quoted. It is noticed as such in the eighteenth Idyllium of Theocritus; and by Aristotle, who has a problem, "why sneezing from noon to midnight was good, but from night to noon unlucky."

SNEGACIUS, CYRIACUS, in *Biography*, in 1590 published at Erford, a tract upon "Harmony, or the Use of the Monochord, an Instrument for measuring and ascertaining the Proportion of Sounds by a single String;" of which he ascribes the invention to the Arabians; the only new idea which we could find in the book, which is written in Latin, and of which the original title is, "Nova et exquisita Monochordi dimensio."

The same author published likewise, in 1590, an elementary tract, entitled "Isagoges Musicae," in two books, the chief merit of which seems to consist in the definitions of musical terms, with short examples in notation.

SNEIRNE, in *Geography*, a town of Persia, in the province of Irac.

SNELL, RODOLPH, in *Biography*, a respectable Dutch philosopher, was born at Oudenwater in the year 1546. After having occupied the situation of professor of Hebrew and mathematics at Leyden for some time, he died in 1613, at the age of 67 years. He was a writer of several works on geometry, and various parts of philosophy.

SNELL, WILLEBRORD, the son of the preceding professor, and an excellent mathematician, was born at Leyden in the year 1591, where he succeeded his father in the professorial chair in 1613, and where he died in 1626, at the premature age of 35 years. He was the author of several valuable works and discoveries. To him we owe the first discovery of the true law of the refraction of the rays of light; and this discovery was made, as Huygens assures us, before it was announced by Des Cartes. Snellius undertook also to measure the earth; and this operation he effected by observing the interval between Alcaer and Bergen-op-Zoom, corresponding to a difference of latitude of $1^{\circ} 11' 30''$. He also determined the distance between Alcaer and Leyden; and from a mean of these measurements, he made a degree to consist of 55,021 French toises or fathoms. These measures were afterwards repeated and corrected by Muschenbroeck, who then found the degree to contain 57,033 toises. His works were numerous, and the principal of them are enumerated in Hutton's Dictionary.

SNELLINCKS, JOHN, was born at Mechlin in 1544. He painted in history and still-life; but he derives his principal renown from his skill in representing battles, particularly attacks of cavalry, which were regarded as pre-eminent among works of that kind. He was honoured by the patronage of the archduke and dukes, and most of the nobility of his day in the Netherlands, and enjoyed all the gratifications which employment and applause are calculated to afford. His taste in grouping is judicious, and he knew how to take advantage of the circumstances of a battle to display his knowledge of chiaro-scuro with great effect. Vandyck appears to have honoured him with his approbation, and has painted his portrait among the distinguished artists of his day, and also etched a plate of it. He died in 1638, aged 94.

SNET, among *Sportsmen*, the fat of all kinds of deer. Dict. Russ.

SNEYDERS, or SNYDERS, FRANCIS, in *Biography*. This ingenious painter was born at Antwerp in 1579, and was

was a disciple of Henry van Balen. At the beginning of his practice he confined himself to fruits, flowers, and other objects of still-life; but he soon advanced to the imitation of animated nature, and in the representation of animals in all the vigour of life and action, in scenes of huntings and fightings, if he has had any rival, he has not been surpassed for freedom, truth, and energy.

Though Rubens was excellent in subjects of this nature himself, yet he frequently employed Sneyders to introduce animals into his pictures: and such was his excellence in colouring and execution, that in this dread competition he rose to a level with his great compeer; and produced an union of spirit and effect, which has rarely occurred where two artists have been engaged upon one canvas. Sometimes Rubens, and Jordaens also, returned the compliment, and painted figures in Sneyders' assemblages of beasts, dead game, fish, vegetables, &c. Of these combined labours, we have many excellent examples in this country; and as Sneyders lived to the age of 78, and was an industrious man, they are not thinly scattered on the continent. It is impossible not to be struck with the astonishing facility with which his works are completed; or with the delicacies of drawing, the correctness and fullness of expression, he has given to his animals, their ferocity or their alarm, even their affection for their young or their benefactor. Vandyck painted an excellent portrait of Sneyders, which was in the Orleans collection, and is engraved in the set of his heads. He himself handled the point, and has left several etchings of various animals. They are now become scarce. He died in 1657.

SNEYDSBOROUGH, in *Geography*, a town of America, in Amson county, North Carolina, on the Great Pedee; 120 miles above George-Town.—Also, a post-town in Richmond county, North Carolina, 418 miles from Washington.

SNIADYN, a town of Lithuania, in the palatinate of Brzesc; 88 miles E. of Pinsk.

SNIATYN, a town of Austrian Poland, in Galicia, on the Pruth; 96 miles N. of Lemberg. N. lat. $48^{\circ} 33'$. E. long. $25^{\circ} 52'$.

SNID-SKARON, a small island in the gulf of Bothnia. N. lat. $65^{\circ} 25'$.

SNIEGULKA, in *Natural History*, the name given by the common people of Poland to a bird of passage, that only comes to them in the colder months.

The name signifies the *snow-bird*; and Rzaczinski, in his History of Poland, calls it *nivalis avis*. The people preface from its coming, the mildness or severity of their winter.

SNIGGLING, a method of fishing for eels, chiefly used in the day-time, when they are found to abscond themselves near weirs, mills, or flood-gates; it is performed thus; take a strong line and hook, baited with a lob or garden-worm, and observing the holes where the eels lie hid, thrust your bait into them by the help of a stick, and if there be any, you shall be sure to have a bite; and may, if your tackling hold, get the largest eels.

SNIPE, *Gallinago Minor*, or *Scolopax Gallinago* of Linnæus, in *Ornithology*, a bird well known among the sportsmen, and which, though in general a bird of passage, yet sometimes remains with us the whole year, and builds and breeds here. Its young are so often found in England, that Mr. Pennant doubts whether it ever entirely leaves this island. It lives in marshy places, and builds among reeds in winter, but in the summer is found in our highest mountains as well as low moors; it lays four or five eggs at a time, of a dirty olive colour, marked with dusky spots.

When snipes are much disturbed, particularly in the breeding season, they soar to a great height, making a peculiar bleating noise, and when they descend, dart down with great rapidity. The cock is observed (while his mate sits on her eggs) to poise himself on his wings, making sometimes a whistling and sometimes a drumming noise. Their food is the same with that of the woodcock, and they are found in every quarter of the globe, and in all climates. See *SCOLOPAX Gallinago*.

These birds are easily taken, by means of lime-twigs in this manner: take fifty or sixty birchen twigs, and lime them all very well together; take these out into places where there are snipes, and having found the places which they most frequent, which may be seen by their dung, set the twigs in these places, at about a yard distance one from another. Other places are those where the water lies open in hard frost and snowy weather; in these places also, and wherever they are suspected to come to feed, let more lime twigs be placed in the same manner. The twigs are not to be placed perpendicularly in the ground, but sloping, some one way, some another; the sportsman is then to retire to a distance, and watch the coming of the birds to these places. When they fly to them, they naturally take a sweep round the earth, and by this means they will almost always be caught by one or other of the twigs. When the first snipe is taken, the sportsman is not to run to take it up, for it will feed with the twig under its wings, and this will be a means of bringing down more of them to the place. When three or four are taken, they may be taken up, only leaving one fast to entice others; and thus the sport may be continued as long as there are any birds of this kind about the place. It may be very proper, when the twigs are planted, to go about, and beat all the open and watery places near, that they may be raised from thence, and fly to those places where the twigs are placed to receive them. The snipe, and also the woodcock, are by a late act comprehended under the class of **GAME**.

SNIPE, *Great*, a species very rarely found in England. See *SCOLOPAX Major*.

SNIPE, *Minor*. See **BITTERN**.

SNIPE, *Jack*. See **JACK Snipe**, and *SCOLOPAX Gallinula*.

SNIPE-Bills, in *Maritime Affairs*, a kind of hooks for falleting the axle-tree of chain-pumps to the bits.

SNISNITZA, in *Geography*, a mountain of Bosnia; 8 miles W. of Bosna.

SNIZORT, a town of the island of Skye. N. lat. $57^{\circ} 27'$. W. long. $6^{\circ} 20'$.

SNORING, in *Medicine, *stertor*, *ronchus*, a sound produced by sleeping persons in particular positions, apparently occasioned by the vibrations of the palate in a state of relaxation, when the respiration is performed by inspiring and expiring the air through the mouth and the nose at the same time. The founder the sleep, and the more completely therefore the parts are relaxed, the louder and more constant the snoring. In the profound coma, which constitutes the sleep of apoplexy, snoring is a characteristic symptom; but the apoplectic stertor is also commonly accompanied by an additional noise, arising from the saliva and mucus, which are not swallowed, being forced through the nostrils, and still more impeding the respiration. A similar stertor likewise occurs in the profound coma produced by an over-dose of opium, or of wine and spirits, which indeed is not always easily distinguishable from common apoplexy, except by the knowledge of the cause.*

This snoring is very different from the noisy respiration, or rattling in the throat, denominated *cerchnos* or *cerchon*, which

which is made in the larynx and windpipe, by the passing of the air through an accumulating fluid, as in cases of asthma, or in the last struggles of exhausted life; of the termination of which, in the latter instance, this rattling sound is marked by the attendants as an unerring sign.

SNORT, in the *Manege*, called in French *elrouer*, denotes a certain sound which a horse of fire makes by breathing through his nostrils; as if he had a mind to expel something that was in his nose, and hindered him to take breath.

This noise or sound is performed by means of a cartilage within the nostrils, called in French *fouris*. Horses of much metal snort, when you offer to keep them in. See **SOURIS**.

SNOTTER, in *Rigging*, a short rope spliced together at the ends, and served with spun-yarn, or covered with hide: it is seized to the size of the mast, leaving a bight, wherein is fitted the lower end of the sprit, which confines it to the mast.

SNOV, in *Geography*, a river of Russia, which runs into the Desna, near Beriezin, in the government of Tchernigov.

SNOW, VALENTINE, in *Biography*, an admirable performer on the trumpet, whose exquisite tone and fine shake must be well remembered by many persons now living, who have heard him at Vauxhall, or in Handel's oratorios.

In 1753 he succeeded Shore as serjeant-trumpet, a place of 500*l.* a-year; after which promotion he ceased to perform in public, which was a serious loss to the frequenters of Vauxhall, where his silver tones, having room to expand in the open air, never arrived at the ears of the audience in a manner too loud or piercing.

SNOW, Nix, a meteor formed in the middle region of the air, of vapour raised by the action of the sun, or subterraneous fire; there congealed, its parts condensed, its specific gravity increased, and thus returned to the earth in form of little white villi, or flakes.

The snow we receive, may properly enough be ascribed to the coldness of the atmosphere through which it falls. When the atmosphere is warm enough to dissolve the snow before it arrives at us, we call it *rain*; if it preserves itself undissolved, it makes what we call *snow*. See **EVAPORATION**.

Dr. Grew, in a discourse of the nature of snow, observes, that many parts of it are of a regular figure, for the most part so many little rowels, or stars of six points; and are perfect and transparent ice, as we see on a pond, &c. Upon each of these points are those collateral points, set at the same angles as the main points themselves; among which there are divers other irregular ones, which are chiefly broken points, and fragments of the regular ones: others, also, by various winds, seem to have been thawed, and frozen again into irregular clusters; so that it seems as if the whole body of snow were an infinite mass of icicles irregularly figured. A cloud of vapours being gathered into drops, the said drops forthwith descend; upon which descent, meeting with a freezing air as they pass through a colder region, each drop is immediately frozen into an icicle, shooting itself forth into several points; but these still continuing their descent, and meeting with some intermitting gales of warmer air, or, in their continual wastage to and fro, touching upon each other, some of them are a little thawed, blunted, and again frozen into clusters, or entangled, so as to fall down in what we call flakes.

Clouds of snow, signior Beccaria observes, differ in nothing from clouds of rain, (see **RAIN**;) but in the circumstance of cold, which freezes them. Both the regular diffusion of snow, and the regularity in the structure of the

parts of which it consists, (particularly some figures of snow or hail, which he calls *rosette*, and which fall about Turin,) shew the clouds of snow to be actuated by some uniform cause, like electricity. He even endeavours, very particularly, to shew in what manner certain configurations of snow are made, by the uniform action of electricity. He adds, that his apparatus never failed to be electrified by snow, as well as by rain; and that a more intense electricity unites the particles of hail (see **HAIL**) more closely than the more moderate electricity does those of snow. Lett. dell' Ellettricismo, p. 520, &c. Priestley's Hist. &c. of Electricity, vol. i. p. 432.

The lightness of snow, although it is firm ice, is owing to the excess of its surface, in comparison to the matter contained under it; as gold itself may be extended in surface till it will ride upon the least breath of air.

The uses of snow must be very great, if all be true that Bartholine has said in its behalf, in an express treatise "De Nivis Usu Medico." He there shews, that it fructifies the earth (which, indeed, is a very old and general opinion); and that it preserves from the plague, cures fevers, colics, tooth-aches, sore-eyes, and pleurisies, (for which last use, his countrymen of Denmark usually keep snow-water gathered in March). He adds, that it contributes to the prolongation of life; giving instances of people in the Alpine mountains that live to great ages: and to the preserving of dead bodies; instances of which he gives in persons buried under the snow in passing the Alps, which have been found uncorrupted in the summer, when the snow is melted.

He observes, that, in Norway, snow-water is not only their sole drink in the winter; but snow even serves for food; people having been known to live several days without any other sustenance.

Indeed, the generality of the medicinal effects of snow are not to be ascribed to any specific virtue in snow, but to other causes.

It fructifies the ground, for instance, by guarding the corn, or other vegetables, from the intenser cold of the air, especially from the cold piercing winds; and it preserves dead bodies, by condensing and binding up the parts, and thus preventing all such fermentations, or internal conflicts of their particles, as would produce putrefaction.

It has been a vulgar opinion, very generally received, that snow fertilizes the lands upon which it falls more than rain, in consequence of the nitrous salts which it is supposed to acquire by freezing. But it appears from the experiments of Margraaf, in the year 1751, that the chemical difference between rain and snow-water is exceedingly small, and that the latter, however, is somewhat less nitrous, and contains a somewhat less proportion of earth than the former; but neither of them contain either earth or any kind of salt in any quantity, which can be sensibly efficacious in promoting vegetation. Allowing, therefore, that nitre is a fertilizer of land, which many are, upon good grounds, disposed utterly to deny, yet so very small is the quantity of it contained in snow, that it cannot be supposed to promote the vegetation of plants upon which the snow has fallen.

The peculiar agency of snow as a fertilizer, in preference to rain, may, without recurring to nitrous salts, erroneously supposed to be contained in it, be rationally ascribed to its furnishing a covering for the roots of vegetables, by which they are guarded from the influence of the atmospherical cold, and the internal heat of the earth is prevented from escaping. Snow may also fertilize the earth, agreeably to the hypothesis of those who make oil the food of plants, by means of the oily particles which

which it contains: besides, snow, in melting, moistens and pulverizes the soil which had been bound up by the frost, and thus fits it for the absorption of the vernal dews and rain; and as its water has a tendency to putrefaction, it seems, on many accounts, without admitting it to contain any nitre, to be admirably adapted to promote vegetation. *Watson's Chem. Ess.* vol. ii. p. 77, &c.

It is supposed by Dr. Darwin, that it may be true, that snows of long duration in our winters may be less injurious to vegetation than great rains and shorter frost. First, because great rains carry down many thousand pounds worth of the best manure into the sea; whereas snow dissolves gradually, the upper surface, as it thaws, sliding over the under part, which remains frozen, and thence carries away less from the land into the rivers; whence a snow flood may be distinguished from a rain flood by the transparency of the water. Secondly, snow protects vegetables from the severity of the frost; since it is generally in a state of thaw where it is in contact with the earth; as the earth's heat is 48° , and that of thawing snow 32° . The plants between them are generally kept in a degree of heat about 40° , by which many of them are preserved. On this account, some plants from Siberia were said to perish by the frosts at Upsal; because the snows did not commence at the same time as in the colder climate from which they were brought. And thus, says he, the lichen *rangiferinus*, coral moss, vegetates beneath the snow in Siberia, where the degree of heat is always about 40° ; that is, in the middle between the freezing point and the common heat of the earth. And as this vegetable is, for many months of the winter, the sole food of the rein-deer, who digs furrows in the snow to find it; and as the milk and flesh of this animal are almost the only sustenance which can be procured by the natives during the long winters of those higher latitudes, this moss may be said to support some millions of mankind. And it is added, that snow protects vegetables, that are covered by it, from cold, both because it is a bad conductor of heat itself, and contains much air in its pores. When living animals are buried in snow, as sheep, or hares, the water which their warmth produces, becomes absorbed into the surrounding snow by capillary attraction, and the creatures are not moistened by its dropping on them; but the cavity enlarges, as the snow dissolves, affording them both a dry and a warm habitation. If this was generally known, many cold and weary travellers in snowy nights might be saved by covering themselves with snow, instead of endeavouring to proceed. It should be added, he says, that Haënsfratz has endeavoured to shew, by ingenious chemical experiments, that rain-water and snow contain both of them a redundancy of oxygen, compared with river-water, which they may have acquired in their descent through the atmosphere; and that as oxygen is shewn by the experiments of Ingenhousz and Senebier, to promote the growth of seeds and of plants, he concludes that rain-water and snow promote vegetation in a much greater degree than river-water and ice, which seems to accord with the popular observations on this subject.

Deep and drifting snows are often very dangerous and troublesome on sheep-farms, and the elevated tracts on which they are kept during the winter season, so as to require and demand much attention in the shepherd to prevent their fatal effects and consequences.

It is a popular error, that the first snow that falls in the year has particular virtues. In Italy they cool their wines all the summer with snow-water.

Snow may be preserved by ramming it down in a dry place under ground, and covering it well with chaff. At Leghorn they use barley chaff for this purpose.

Snow and ice are also preserved with straw or reeds. Mr. Boyle has described the manner in his experimental history of cold. See ICE and ICE-HOUSE.

It is usual in hot countries to mix snow and ice with their wine. Hence Pliny says, "Hi nives, illi glaciem potant, pœnasque montium in voluptatem gulæ vertunt."

Signior Sarotti, in the Philosophical Transactions, mentions a red, or bloody snow, which fell on the mountains La Langhe, near Genoa, on St. Joseph's day. This snow, when squeezed, yielded a liquor of the same red colour.

Snow of a very bright red colour has sometimes been found on the summits of the highest mountains. The matter which colours it burns with a smell similar to that of a great many vegetable substances. Saussure, who often collected such snow on the Alps, was induced by this property, as well as by its being found in summer, and in places where many plants were in flower, to consider the colouring matter as the farina of some plant. C. Ramond, who found this dust on the snow of the Pyrenees, remarked, that it is heavier than water, and hence suspected it to be of mineral origin; and he, indeed, found that it arises from the decomposition of certain micas. This decomposition requires, without doubt, the conditions mentioned by Saussure; for C. Ramond found, that they are necessary on the Pyrenees, as well as on the Alps.

Snow, in *Sea Language*, is generally the largest of all two-masted vessels employed by Europeans, and the most convenient for navigation. The sails and rigging on the main-mast and fore-mast of a snow are exactly similar to those on the same masts in a ship, only that there is a small mast behind the main-mast of the former, which carries a sail nearly resembling the mizen of a ship. The foot of this mast is fixed in a block of wood on the quarter-deck, abaft the main-mast, and the head of it is attached to the after-part of the main-top. The sail, which is called the try-sail, is extended from its mast towards the stern of the vessel. When floops of war are rigged as snows, they are furnished with a horse (see HORSE), which answers the purpose of the try-sail-mast, the fore-part of the sail being attached by rings to the said horse, in different parts of its height. Falconer.

Snow-Ball Tree, in Botany, a species of *Viburnum*; which see.

Snow-Berry. See CHIOCOCCA.

Snow-Berry Bush, a species of *Lonicera*; which see.

Snow-Bird, in Ornithology, the *EMBERIZA Nivalis* of Linnæus; which see.

These birds are called in Scotland *snow-flakes*, because they appear in hard weather and in deep snows. Some few breed in the Highlands, on the summits of the highest hills, but the greatest number migrate from the extreme north. Their appearance is a certain forerunner of hard weather and storms of snow, being driven by the cold from their common retreats. Their progress southward is probably thus: Spitzbergen and Greenland, Hudson's Bay, the Lapland Alps, Scandinavia, Iceland, the Ferro isles, Shetland, Orkneys, Scotland, and the Cheviot hills. They visit, at that season, all parts of the northern hemisphere, Prussia, Austria, and Siberia. They arrive lean and return fat. In their flight they keep close to each other, and sing themselves collectively into the form of a ball, at which instant the fowler makes great havoc among them. Pennant.

Snow-Drop, in Botany. See GALANTHUS.

Snow-Drop, Great. See LEUCOIUM.

Snow-Drop Tree. See CHIONANTHUS.

Snow-Maill, in Sheep Farming, a term usually applied by the

the farmers in the northern parts of the island, to the sum of money paid to any person who may be in possession of low grounds, for permitting their sheep to feed thereon in times of deep snows.

Snow-Plough, in *Rural Economy*, a contrivance made use of in Sweden, and other northern countries, for the purpose of clearing roads from snow; and which might probably be employed here with advantage in the same intention. It consists of a shaft, to which the horses are yoked, usually two abreast, and one before. The sleds are constructed of three or four deals, well jointed and nailed together, having more or less height, according as the snow is more or less deep, as from three to four feet. The length is usually about fifteen feet, and two iron bars are nailed to the bottom, to make it slide with greater facility. It has also a box for the purpose of being loaded, to keep it down. It may have any breadth, from fifteen to twenty feet, according as the snow may want clearing. There is a representation of an implement of this kind in the first volume of *Communications to the Board of Agriculture*.

Snow-Stone, in *Natural History*, a name given by some to a very beautiful stone found in America; of which the Spaniards are very fond, making it into tables, and other ornaments, in their houses. Alonso Barba, who had seen much of it, tells us, that it is found in the province of Atacama, usually in pieces of four feet long, and four or five inches broad; so that they are forced to join them in the working. Its general thickness is about two inches. It has a great variety of colours, which form clouds and variegations of a very beautiful kind. The principal colours are red, yellow, green, black, and white. The white is generally formed into spots on the very blackest parts of the mass, and is so beautifully disposed, that it represents snow falling in all its whiteness upon a jetty surface.

Snow Mountains, in *Geography*, a range of lofty mountains, which forms an extensive district in Southern Africa, near the Cape of Good Hope. The whole range of hills which is included under this name forms a large group, of which the two great parallel chains from the west, with another not less extensive chain from the north-east, and a smaller from the south, are all united. The name, in itself, indicates a pretty considerable height; and, in fact, the highest point, called the "Compass-Hill," is, according to the calculations of colonel Gordon, about 300 feet higher than the summit of the "Kamberg," and, consequently, 6500 feet above the level of the sea. This hill is distinguished more particularly from all others in Southern Africa, by being less insulated; or, in other words, it is surrounded every way by hills of a constantly decreasing elevation, till they are lost at length in the plain. On all sides, the slopes are gradual from the summit, so that the traveller may be constantly ascending for several days together, by tolerably commodious paths, without encountering any dangerous steeps, any deep chasms, or rugged precipices. The heights are all rounded like domes; the valleys are spacious and open; and even considerable plains stretch in some places between one ascent and the next. The aspect of the whole mountain is rather naked and uniform than wild and majestic: on account of the gentleness of the acclivity, and the level nature of the valleys, the water does not rush down in torrents, or form deep channels, but rather sinks into the earth; and to this circumstance the fertility of these mountains is to be principally ascribed. In its marshy hollows, the horned cattle find excellent pasture, and the ridges and heights being scattered over with small aromatic plants, the sheep are furnished with an abundant supply of the most salutary nourishment. The climate in the higher parts is cold

in winter, and deep snows fall, which continue to lie upon the ground for many weeks. Nevertheless, the greater part of the country is habitable; the inhabitants of the other parts that are not so, descend into some of the lower parts, where they have a "legplaats," or winter habitation, during the short period in which they are obliged to quit their more elevated situation. In this respect the Snow mountains have a very decided preference over the Roggeveld; and, besides, the weather, in winter, though cold, is clear and bright, whereas, in the Roggeveld, there are often thick fogs, which are very injurious to the cattle.

Three considerable rivers have their sources in the Snow mountains, which are constantly supplied with water through the whole year, from the melted snows and the rain-water. Towards the S. flows the Zondag's river; towards the E. several small streams, which at last unite to form the great Fish river; and at the foot of the mountains on the N. side, rises the Sea-Cow river, which flows into the Orange river, which latter, subsequent to this union, continues its course for more than 100 miles, when it falls into the sea on the western coast. Both the other rivers run in a southerly direction.

The upper stratum of the Snow mountains consists of a large-grained sand-stone, intermingled at intervals with quartz. Lower down they consist of a schist, varying in different parts, both in thickness and colour; but no granite is found here. The soil throughout is a soft argile, which, as well as the sand-stone, is in many parts very much oxidated. The ground is almost every where strewed with loose stones, which very much contribute to keep it cool in summer, and also assist in promoting the vegetation of the plants. Here is no want of springs, and therefore the country is tolerably populous; it is very favourable to the breeding of cattle, and most of the inhabitants are in easy circumstances. But through the country the springs, though constantly flowing, do not yield such an abundance of water as to allow of sufficiently watering the fields for agricultural purposes. On these hills no tree grows; and it is justly observed by Mr. Barrow, that here are people, who in their whole lives never saw a wood, or even a copse. The want of wood prevents a supply of fuel, so that people are obliged to burn the dung of their cattle dried. The bleak wind of winter is particularly adverse to the cultivation of nut or fruit-trees, and even the oak will not thrive. The locusts in this country are very numerous, and very destructive. Game is abundant, but the lions and leopards do great mischief among the flocks and herds. But of all the enemies which this country has to dread, the Bosjesmans are the most formidable, whose maraudings occasion annually a loss of five out of every hundred of the sheep and oxen. The breeding of sheep is the most important occupation of the colonists in these parts. The sheep of this country and of the Roggeveld are the most weighty of any in the colony, and their flesh is reckoned the best flavoured. Some farmers have flocks to the amount of 6000 or 7000, and few have less than 3000. The cattle are not less profitable. The cows give rich milk in abundance, more so than in other parts; and great quantities of butter are carried to Cape Town. Mr. Barrow reckons that a herd of 50 cows will produce at least 100 pounds of butter in a week. The inhabitants of the Snow mountains are a vigorous and cheerful race. Mr. Barrow, it is said, associated with some of the most worthy and respectable people of the colony, and seems to have entertained too favourable an opinion of their general character, as others have found them less friendly and hospitable. It is observed, that without such dogs as this country affords, it would be absolutely uninhabitable. By these the inhabitants are

are defended, not only from their four-footed enemies, but also from the Bosjesmans. Nothing can be compared to their watchfulness; the leopard, the jackal, even the lion himself, are terrified with the barking of the faithful troop, and hasten to retreat.

SNOW-BIRD LAKE, a lake of North America, W. of Hudfon's bay; 12 miles wide from E. to W., but from N. to S. much more extensive.

SNOWDON MOUNTAINS, a cluster or ridge of lofty hills in the county of Caernarvon, North Wales, are situated to the S.E. of the county-town, stretching to the confines of Merionethshire. They are called by the Welsh the mountains of Eryri, and according to an ancient proverb, mentioned by Giraldus, were considered to be so extensive and productive, as to be capable of affording sufficient pasture for all the herds in Wales, if collected together. The same author informs us, that there were two lakes on the high part of these hills, one of which was remarkable for a floating island, and the other for three kinds of fish, *viz.* eels, trout, and perch, which had "only one eye, the left being wanting." The highest summit of this ridge is called by the inhabitants Y Wyddfa, or the Conspicuous, and by the English, specially Snowdon. Though confessedly the highest mountain in Wales, being, according to Pennant, 3567 feet above the level of the sea, it is by no means the most picturesque in its form; for Cadair Idris, Moelwyn, and Arran, in North Wales, and the Cadair Arthur, near Brecknock, in South Wales, present a far bolder outline. Camden remarks of these mountains, that they may be very properly termed the British Alps; "for besides that they are the highest of all the island, they are also no less inaccessible by reason of the steepness of their rocks than the Alps themselves; and they all encompass one hill, which far exceeding the rest in height, does so tower its head aloft, that it seems, I shall not say to threaten the sky, but to thrust its summit into it. It harbours snow continually, being throughout the year covered with it, or rather with a hardened crust of snow, and hence the British name of Craig Eryri, and the English one of Snowdon."

Snowdon was held as sacred by the ancient Britons, as Parnassus was by the Greeks, and Ida by the Cretans. It is still said, "that whosoever slept upon Snowdon would wake inspired, as much as if he had taken a nap on the hill of Apollo." The Welsh also have always had the strongest attachment to the tract of Snowdon. It was, say they, the appurtenance of the principality of Wales, which the prince and his predecessors held from the days of Brute. One of the titles of the prince was that of lord of Snowdon: and, indeed, such was the importance attached to this strong region, that when Llewellyn was at his last extremity, he rejected "the proposal of Edward, of a thousand a-year, and some honourable county in England, to give it up, well knowing that his principality must terminate with the cession." When the English monarch afterwards effected the complete conquest of Wales, he held a triumphal fair upon this mountain, and adjourned to finish the joy of his victory, by solemn tournaments on the plains of Nevin. After this event the tract of Snowdon was annexed to the crown of England, and continued to be a royal forest as late as the reign of queen Elizabeth. Leland informs us, that in his days stags were found here in such numbers, as to destroy the little corn the farmers attempted to sow; but these, Pennant tells us, were extirpated before the year 1626. The same author adds, "Snowdon being a royal forest, warrants were issued for the killing of the deer. I have seen one from the duke of Suffolk, dated April 30, 1552, and

another in the first year of queen Elizabeth, signed by Robert Tounesend; and a third, in 1561, by Henry Sydney. The second was addressed to the master of the game, ranger, and keeper of the queen's highness forest of Snowdon, in the county of Carnarvon. The last extended the forest into the counties of Meirionydd and Anglesea, with the view of gratifying the rapacity of the favourite, Dudley, earl of Leicester, who had by letters patent been appointed chief ranger." Pennant's Tour in Wales, vol. ii. 4to. The Itinerary of Archbishop Baldwin through Wales, A.D. 1188, by Giraldus de Barri, translated by sir R. C. Hoare, bart. 4to. 1806. Aikin's Tour in Wales, 8vo. Wyndham's Tour in North Wales, 4to. Hutton's Remarks on North Wales, being the Result of Sixteen Tours, 8vo. 1803. Bingley's Tour round North Wales, 2 vols. 8vo. 1800. Caernarvonshire, or some Account of its Antiquities, Mountains, and Productions, 8vo. 1792.

SNOW-HILL, a sea-port of Maryland, and capital of Worcester county, situated on the S.E. side of Pokomoke river, containing about 60 houses, a court-house and gaol; the inhabitants of which deal principally in lumber and corn; 158 miles from Washington. N. lat. 38° 11'. W. long. 75° 30'.

SNOWSWICK Pine-Apple Cheese, in *Rural Economy*, a particular sort of cheese made about that place in Berkshire, which are of the pine-apple shape and external appearance. They are principally made upon the farm of a Mr. Pike, and some others, in the parish of Buscot, which are famous for them. They sell considerably higher than those cheeses which are made in the common forms, and they are justly entitled to the distinction and increase of price, in consequence of their peculiar richness, and the delicacy of their flavour. When kept to the proper age, they are, perhaps, not inferior to any cheese in the kingdom.

In regard to the method of making them, the first part of the process is exactly the same as for the common sort. The curds are then well worked and broken down with the hands, after which the whole is pressed into a wooden mould, contrived in the shape of a flower-pot, being afterwards hung up and suspended from beams, rafters, or pegs, in an airy apartment, in a net, the meshes of which mark and indent the surface in the manner of the pine-apple. Salt is then rubbed into and over them, or they are steeped in a suitable brine made from that substance. On the above person's farm, the first of these methods is thought to be the most proper and adviseable. No sort of continued pressure is employed, and yet in firmness, it is said, when dry, these cheeses cannot be distinguished from those which have undergone the force of pressure in cheese-presses.

One of these pine-apple cheeses, for the most part, weighs about five pounds, and in good years, it is said, that two tons of them are made on the farm already noticed alone. It is, indeed, scarcely known that they are manufactured any where else.

Some cheeses are made in other parts of this district, as about Stanford, in the Vale, in the fanciful shape of a hare sitting in her form. These are likewise sometimes coloured with sage. See CHEESE and DAIRYING.

SNUFF, a preparation of tobacco, made by reducing it into a powder, fit to be taken in at the nose, in order to purge or clear the head of pituita.

Ordinarily, tobacco is the basis of snuff; other matters being only added to give it a more agreeable scent, &c. The kinds of snuff, and their several names, are infinite; and new ones are daily invented; so that it would be difficult, not to say impossible, to give a detail of them. We shall only say, that there are three principal sorts: the first granulated

nulated; the second an impalpable powder; and the third the bran, or coarse part remaining after sifting the second fort.

The many mischiefs attending the unnatural practice of taking this powder of tobacco at the nostrils, have been described by the writers in general on these subjects, since this pernicious custom has reigned in the world; but one of the most remarkable accidents, occasioned by it, is related in the *Acta Eruditorum*, which was the forming of a polypus in the œsophagus, that killed the patient, by starving him, from an inability of swallowing. *Act. Erudit. an. 1715, p. 475.* See *PICA Nafi.*

SNUFF, or *Snuffler*, in the *Manege*. See *SNORT*.

SNUG BAY, in *Geography*, a bay in the Straits of Magellan, N.N.W. of Cape Froward.

SNUG Bay Point, a cape in the Straits of Magellan; 8 miles N.N.W. of Cape Froward.

SNUG Corner Cove, a bay of the North Pacific ocean, on the E. side of Prince William's sound, on the W. coast of North America. N. lat. 60° 50'. W. long. 146° 30'.

SNYING, in *Ship-Building*, a term applied to those planks, whose edges curve or round upwards. The great injury occasioned in full bows or buttocks is only to be prevented by introducing steelers. See *STEELERS*.

SNYTE, in *Geography*, a river of England, which runs into the Dean, in Nottinghamshire.

SOA, a town of the island of Cuba; 60 miles N. of St. Yago.

SOA, a small island of the Hebrides, or Western islands of Scotland, situated near the celebrated isle of St. Kilda. It is about a mile in circumference.

SOACA, in *Ancient Geography*, a town situated in the interior of Arabia Felix, according to Ptolemy.

SOAGGIO, in *Ichthyology*, the name of a fish common in the markets of Rome and of Venice, and of the turbot kind. See *LUG-a-leaf*.

SOAID, in *Geography*. See *SAIDOU*.

SOAK, or *SOVIAK*, a town of Arabia, in the province of Mascat, on the E. coast; 5 miles N.W. of Burka.

SOAKAGE, in *Agriculture*, a term applied to the water that drains through the banks or other parts, in fen and other moist districts. It is very considerable and troublesome in some instances, so as to cause much expence. See *EMBANKMENT*.

SOAL, or *SOLE*, in *Ichthyology*, the English name of the fish, called by the generality of authors the *buglossus*, by some *solea*, and the *PLEURONECTES Solea* of Linnæus, which see. Some authors call it the *linguacula*.

The foal is found on all our coasts, but those on the western shores are much larger than those of the north. They are usually taken in a trawl-net; they keep much at the bottom, and feed on small shell-fish. The small foals are much superior in goodness to the large ones.

Soals may be taken at any time of the year, but they must not be under seven inches from the eye to the end of the tail. 1 & 2 *Geo. I. cap. 18.*

SOAL, *Smooth*, from its transparency called the *lantern-fish*. See *PLEURONECTES Arnoglossus*.

SOALTERPOUR, in *Geography*, a town of Bengal; 20 miles E. of Rangamatty.

SOAMUS, (*Tjhamou*), in *Ancient Geography*, a river of India, on this side of the Ganges. Its source was in mount Emodus, S. of the Hydaspes, into which it discharged itself N.E. of Bucephala.

SOANA, a river of Asiatic Sarmatia, the mouth of which is placed by Ptolemy on the western coast of the Caspian sea, above the town of Telcha.—Also, a river of

the island of Taprobana, so called by Ptolemy, who places its mouth on the western coast, between the promontory of Andrasimundum and the town Sindocanda.—Also, a town of Italy, in Etruria, N.W. of the Volturni.

SOANA, in *Geography*, a town of Etruria, the see of a bishop, suffragan of Siena; 24 miles N.E. of Orbitello.

SOANA, a mountain of France; 10 miles S. of Aosta.

SOANDA, or *SOANDUS*, in *Ancient Geography*, a town of Cappadocia, between Therma and Sacæna, according to the Itinerary of Antonine.

SOANE, in *Geography*, a river of Hindoostan, which rises in the country of Allahabad, about 30 miles S.E. from Sohagepour, and runs into the Ganges, near Patna.

SOANEN, JOHN, in *Biography*, a French prelate, was born at Rioms in 1647. His father was an attorney in the presidial court of that city; his mother was niece of the learned Jesuit Sirmont. In 1661 he entered the congregation of the Oratory at Paris, where he took for his confessor the celebrated father Quesnel. After teaching the languages and rhetoric in several of the seminaries of the society, he devoted himself to pulpit services, and with so much success, that he became one of the four distinguished preachers of the congregation, who were popularly denominated the four evangelists. Fenelon joined him with Massillon as models of pulpit eloquence. In 1695 he was placed in the see of Seneza, a bishopric of small revenue, but which, being in a retired situation, required little of the parade of office, and permitted him to expend the greatest share of his income in charity. To his various virtues as a Christian pastor, he united a firmness which enabled him to sustain the part of a martyr to principle. On the publication of the bull *Unigenitus*, which contained a condemnation of Quesnel's opinions, he appealed against it to a future council, and published a pastoral letter, in which he controverted its positions with great force of argument. Cardinal Fleury, resolving to make an example of a disobedient prelate, selected Soanen for a victim; and in 1727, assembling the council of Embrun, procured a condemnation of the licentious bishop, who was suspended from his priestly and episcopal functions, and exiled. In his retreat he had numerous visitors, who paid him the respect due to his virtue and integrity. He died in the year 1740, at the age of 92, revered by the Jansenists as a saint, and condemned by the Molinists as a rebel. He was author of "Pastoral Instructions," "Charges," and "Letters," which were printed, with his "Life," in 2 vols. 4to. and 8 vols. 12mo.

SOANES, in *Ancient Geography*, a people of Asia, in the Colchide, being of the number of those who were in the general assembly of Dioscurias, and who inhabited the summits of mount Caucasus, above the town of Dioscurias, according to Strabo.

SOANGUR, in *Geography*, a town of Hindoostan, in Guzerat; 50 miles S. of Surat. N. lat. 21° 10'. E. long. 73° 33'.

SOANK, a town of Hindoostan, in Bahar; 45 miles S.S.E. of Bahar.—Also, a river of Hindoostan, which rises near Burwah, in Bahar, and runs into the Bramnee, near Khoud, in Orissa.

SOAP, in *Chemistry*, is a name for those bodies which are compounds of the alkalies with fat and the fixed oils. The earths and the other metallic oxyds also combine with fat and oils, forming neutral compounds. The former have been called earthy, and the latter metallic soaps.

The soaps formed by the alkalies have the distinguishing character of being soluble in water and alcohol. The earthy soaps

soaps are perfectly insoluble. And since any of the earths have a stronger attraction for oil than the alkalies, the alkaline soaps are always decomposed by the earths. This occasions the curdy appearance when soap is used with water containing any earthy or metallic salt. It is from this quality that waters are said to be hard.

The earthy soaps are of a greyish-white colour, of a curdy appearance. The metallic soaps are of different colours. Both these and the earthy soaps are formed by adding a solution of an alkaline soap to a solution of an earthy or metallic salt. A precipitate is formed, which is the soap to be obtained. With a solution of iron containing the red oxyd, the soap is of an orange-red colour. It has the consistency of a salve or plaster, but by exposure to the air it becomes dry and friable, but may be softened by heat. When a similar solution of soap is added to a solution of sulphate of copper, a green soap is formed, which is a fluxible mass like wax. Corrosive sublimate, treated in this manner, gives a red soap. All the metallic oxyds may be combined with fat or oil in a similar way.

SOAP, in the *Manufactures* and *Domestic Economy*. This is confined to soaps made with the fixed alkalies, combined with different kinds of fat and oil. These, in the manufacture of soap, are divided into two principal varieties, *viz.* hard and soft.

1. *Hard Soap*.—The alkali employed for hard soap is soda, generally obtained from the different sea vegetables, and called by different names, according to the name of the plant in different countries. Most of the *algæ*, but particularly the *fucus* and *salsola*, afford soda by burning. The vegetables are first dried, and then burnt in pits formed with loose stones. The earthy matter and the soda, with some neutral salts, fuse into a crude mass, in which state it is sold. This substance is furnished in great abundance from the Highlands of Scotland, under the name of *kelp*, and from Alicant in Spain, under the name of *barilla*. In France it is known by the name of *varec*; this being the name of the plant from which it is generally produced there.

It is commonly, however, in this state that it comes to the soap-maker, varying frequently in its value, and often occasioning much uncertainty in its employment. It should be the first business, therefore, of the manufacturer, to assay the substance from which he gets his alkali, even before he purchases it. For this purpose a given quantity should be dried and weighed. After reducing it to powder, it must be treated with hot rain-water, till the water coming from it has no taste, reserving all the portions of water added from time to time. Concentrate this liquid by evaporation, till the quantity of liquid is not more than three times the weight of the quantity taken to be assayed. Now weigh out a quantity of sulphuric acid, say half the weight of the assay. From this quantity take small portions at a time, and add them to the solution above-mentioned, stirring it at the same time with a wooden rod. When the escape of gas begins to diminish on the addition of fresh acid, let the additional portions be very small. Now take bits of paper stained blue with litmus: on dipping one into the liquid, if more acid is wanting, the paper will not be changed, but the moment the paper is turned red by the liquid, cease to add sulphuric acid. Let the remaining acid be now weighed, in order to know what has been used, and note this down. Now take pure sal soda (carbonate of soda) in well-formed crystals, exactly of the same weight with the first assay, and dissolve it in three times its weight of pure water. Weigh out the same quantity of sulphuric acid as before, and just follow the same steps as above directed, till the litmus paper just turns red, then weigh the remaining acid, to obtain the quan-

tity used, and note down as before. Then say, as the acid consumed by the sal soda is to that consumed by the assay, so is 100 to a number which will give the *per centage* of carbonate of soda contained in the crude alkali. Thirty *per cent.* of the carbonate of soda so indicated will be real soda, the only substance which combines with the fat to form soap. When the exact value of the alkali is known, it is then to be treated as follows, to prepare it for mixing with the fat.

The kelp or barilla is first to be pounded, and then mixed with one-fifth its weight of quicklime, in a large vat. These vats are generally three or four in number to each boiler. They are frequently made with brick-work, from four to five-feet cubes, but sometimes of cast-iron. Besides these vats for the infusion of crude alkali, each of these has a similar cavity under it. The bottom of the vat is even with the ground, the under vat being sunk below, and is intended to receive the liquor which runs from a plug-hole in the upper vat, when the infusion has gone on to a certain extent. One of these vats, with its under reservoir, is sufficient for one boiling, but they are generally all at work, in order to give time for the solution of the alkali from the crude mass.

In charging a vat, the barilla, kelp, or potash, and sometimes mixtures of these, are first coarsely powdered, and mixed with quicklime also coarsely powdered; some water is then thrown upon these to slake the lime. In the side of the vat some straw is first placed about the plug-hole, to prevent bits from passing through. The vat is now charged, and water poured upon the materials till it stands considerably above the solid mass. After standing several hours the plug is withdrawn, to let out the solution into the lower reservoir. The plug is now returned, and fresh water poured upon the materials. Some or all the first ley is now removed into one of the other lower reservoirs before the second infusion is drawn off. This is done, that the soap-boiler may always have at command two leys of different degrees of strength, as in the course of every boiling he finds it necessary to use sometimes the weak and at other times the strong.

The number of waters to be added to the materials depends upon the judgment of the workman, who by his taste can tell when the water has dissolved the whole of the alkali. The times of charging the vats are irregular with respect to the times of charging the boiler. Some one of the vats is constantly employed, in order to insure a constant supply of the ley.

The boilers are made to hold from about 20 to 25 cwt. of soap; they are made in two parts, the lower part being about three feet in diameter, and the same in length: under the bottom of this the fire acts. The top part has a flange, to which the upper part is screwed. The latter is nearly an hemisphere, rising above the floor just sufficient to allow the workman to stir the soap when he stands up.

The ley being ready to lade out of the reservoir, which is near to the boiler, the tallow or oil first weighed is put in. When it is sufficiently melted, the workman begins by adding the ley, and stirring the mixture. The alkali and the oil soon begin to unite, forming a milky fluid. As more ley is added, and the stirring continued, the liquid thickens. This is continued generally for 30 hours, and frequently more, till small portions of the soap, taken out from time to time, assume a proper consistence, which the workman by constant experience understands. He now adds a quantity of common salt, which has the effect of separating the watery part from the soap, which contains a portion of neutral salts, that existed in the crude alkali, and sometimes also free alkali, especially when more than enough has been added. The fire is now to be withdrawn, and the mass left to cool. The watery part will be found at the bottom, and
requires

SOAP.

requires to be pumped out by a pump, which is a fixture on the side of the boiler. When this has been removed the fire is rekindled, and if the mass does not melt freely, a little water is added. As soon as the whole becomes liquid, and is made uniform by agitation with wooden poles, the fire is again withdrawn, and the mass allowed to assume a proper consistence for lading. It is laded into square moulds: these are composed of a number of strata lying one upon another, so that when the soap has become solid, each layer of frame-work can be removed, beginning at the top, and the soap is cut into cakes with a piece of small brass wire at every interval: these cakes are afterwards cut into square prismatic pieces, in which state they are sold.

Some manufacturers proceed in a different manner in boiling the soap. In the method above described, and which is practised by a judicious soap-boiler in Derby, the watery part, or what is called the spent ley, is not separated till all the ley is added. This method is called close working, because the liquid is of an uniform thickness all the time, till the salt is added: it then assumes what is called the granular form, in which the watery part is separated from the soap, like the whey and the curd in making cheese. This arises from the soap being insoluble in salt-water. In this state the soap is said to be open, to distinguish it from the state in which it exists before the salt is added, and in which the soap is said to be closed. In the open working the common salt is added at several intervals, in order to keep the soap separated from the water. The fire is also withdrawn several times, and as many times the spent leys are pumped off. After each time, except the last, fresh ley is added and the stirring repeated. The proper state for the soap is known by the appearance of the bubbles. The very hard soap, or that which is made with all soda, is not the most convenient for practice; it is neither so fit for washing the hands, nor so easily reducible to a pulpy state for the different manufactures in which it is employed. The hard white soap, produced in the manufactory above alluded to, is in great repute from its whiteness and its proper consistency. This soap is formed with tallow and a mixture of soda and potash. The boiler holds from about 25 to 27 cwt. of soap. The following are the average proportions of the materials employed; 13 cwt. 2 qr. 16 lbs. of tallow, 5 cwt. 3 qr. 12 lbs. barilla, 3 cwt. 2 qr. 6 lbs. American potash, 4 cwt. 2 qr. 7 lbs. quicklime, and 3 qr. 16 lbs. common salt (muriate of soda.) These materials produce 1 ton 4 cwt. 0 qr. 1 lb. of white soap. The lime, the barilla, and the potash, are mixed together, and placed in the vat already described. In order to furnish the ley which is added to the melted tallow, the lime is employed merely to rob the potash and soda of their carbonic acid, and of course does not enter into the composition of the soap. The neutral salts, which both the barilla and potash contain, are pumped out with the spent leys with a portion of uncombined alkali: of this we shall say something hereafter.

Hence it will appear, that the soap is a compound of pure alkali, with the fat, and a portion of water.

In the making of soap, as in all other chemical combinations, the proportions appear to be definite. Every soap-boiler knows, that where too much ley is added to the fat, the excess will be found in the watery part under the soap; and that if the fat were in excess, the soap would be greasy to the feel, and would otherwise shew the presence of uncombined fat. Hence it will be found on analysis, that the proportions will be uniform, because they are definite. The quantity of soda which combines with olive-oil and tallow,

is about 30 of the former to 212 of the latter; and since an atom of potash is to that of soda as 29.25 to 44.5, 45 of potash will combine with 212 of oil or tallow.

The following is an analysis of soap by Darcet, Lelievre, and Pelletier:

Oil	-	-	-	60.94
Soda	-	-	-	8.56
Water	-	-	-	30.5
				100

If the alkali were potash instead of soda, then the proportions would be,

Oil	-	-	-	58.4
Potash	-	-	-	12.3
Water	-	-	-	29.3
				100

In the first of these analyses, the soda is to the oil as 85 to 609, or as 1 to 7.28 nearly. In the second, the potash is to the oil as 12.3 to 58.4, or as 1 to 4.6 nearly. The specimen of soap before alluded to contains a mixture of potash and soda. The 3 cwt. 2 qr. 6 lbs. of American potash, according to the average value of that article, ought to give 2 cwt. 2 qr. of pure potash. By the above analysis, the 1 ton 4 cwt. 0 qr. 1 lb. of soap ought to contain 7 cwt. 1 qr. 7 lbs. of water. There ought to be therefore only 16 cwt. 3 qr. 21 lbs. of the alkali and tallow. It appears, that in forming this specimen of soap, 100 lbs. of common salt were added, which gives to the soap 55.5 lbs. of soda, and takes away from it 83.25 lbs. of potash. Hence, the alkali resulting from the potash in this soap will be 1 cwt. 3 qr., and 55.5 lbs. of soda derived from the common salt, or 2 qr. 4 lbs. nearly. In order to know what soda is derived from the barilla, we must subtract the tallow and the alkali from the whole; that is (16 cwt. 2 qr. 27 lbs.) 1 cwt. 3 qr. of potash, 2 qr. of soda, and 13 cwt. 2 qr. 16 lbs. of tallow, will leave 3 qr. 6 lbs. of soda derived from the barilla.

The proportions of the soap in question will, therefore, be, in 2689 lbs. of soap,

Tallow	-	-	-	1528	or 57
Soda	-	-	-	146	5.4
Potash	-	-	-	196	7.3
Water	-	-	-	819	30.3
				2689	100

This result, although it contains a little too much of the mixed alkali to correspond with theory, is strikingly near the truth. We may therefore conclude, that soap, in general, contains from 8 to 12 per cent. of alkali, as more or less of each prevails, and about 30 per cent. of water. The hardest white soap made with soda would contain 8 per cent.; and the soft soap, in which potash alone is used, would be a little more than 12 per cent.

In the above specimen of hard soap, it will be seen that 398 lbs. of crude potash furnish 280 lbs. of real alkali, which is seven-tenths of the whole. With this were employed 656 lbs. of barilla, which furnish 90 lbs. of real alkali. Now 192 lbs. of American potash will produce 135 lbs. of pure potash, and this will disengage from 126 lbs. of muriate of soda, or common salt, 90 lbs. of pure soda. Hence 192 lbs. of American potash and 126 lbs. of salt will produce as much soda as 656 lbs. of barilla.

This

SOAP.

This weight of barilla, at the present price, costs 10*l.* 5*s.*: 192 lbs. of potash will now cost 6*l.* 17*s.*; and 126 lbs. of common salt, 1*l.* 17*s.* These two sums are 8*l.* 14*s.* The saving, therefore, in employing potash and common salt, in making even the best hard white soap, instead of barilla, is nearly 5 per cent. But if the two alkalies are to be contained in equal proportions, then about half the common salt only need be used, and the saving will be very considerable. It will also appear evident, that soap may be made of any degree of hardness, by using more or less of common salt with the potash; and that if no salt at all be used, the soap will be soft.

The difference of price between barilla and potash is often much more than at present in favour of using potash: this will make the saving above mentioned more conspicuous.

It must also be remembered, that some salt is always used for the purpose of separating the spent leys from the soap. This has been stated at about three-quarters of a cwt. to 24 cwt. of soap. It seems that a solution of salt of this strength does not dissolve soap.

Hard Soap, Yellow.—This soap is formed of similar proportions of soda and tallow with the last; but it also contains rosin, and sometimes palm oil.

The following are the average proportions of the materials for making yellow soap, which may be relied upon.

Tallow.	Rosin.	Palm Oil.	Barilla.	Potash.	Lime.	Soap produced.
Cwt. qr. lb.						
13 0 11	3 2 18	1 0 0	6 2 14	1 0 16	5 0 9	26 1 21

The whole weight of the materials, exclusive of the lime and the refuse of the potash and barilla, is equal to 24 cwt. 0 qr. 1 lb.; the soap, independent of the water it contains, is 18 cwt. 0 qr. 25 lbs.: this, taken from 24 cwt. 0 qr. 1 lb. leaves 5 cwt. 3 qr. 4 lbs. for the refuse of the tallow, rosin, and palm oil. That the tallow must make much waste will be easily conceived, from the most inferior kind being used. The rosin and oil must also yield much refuse. This refuse is found all together at the bottom of the pan after boiling, and is known in the manufactories under the name of *nigre*.

In boiling the yellow soap, the rosin, oil, and tallow are put into the boiler first. The ley is prepared in a similar vat, and managed in other respects in the same mode as in forming the white soap.

The manner too of adding the ley from time to time, and the stirring, are just kept up in a similar way, till the fatty matter is fully saturated. The time required for boiling the quantity of soap stated above, is sometimes as much as three weeks, during which time it is kept in what is called the open state, that is, the watery part is completely separated from the soap. It would appear that this soap requires merely the presence of the neutral salts in ley to keep it in the open state. This arises probably from this being a less perfect soap, and less soluble in water. The soap appears in small lumps, perfectly detached from the fluid. At the end of every day the soap is allowed to cool, when the thin part sinks to the bottom: this is spent ley, and is pumped off every morning. The fire is again raised, and fresh leys added: the boiling and stirring go on again. This action is repeated till the fat is said to be killed. This, as we have observed, takes sometimes fifteen or twenty days. When this change is complete the fire is withdrawn, and the mass allowed to cool: the last ley is pumped out. The addition of a little water, and the fire being raised, allow the soap

to be dissolved, and the refuse, which is principally the substance we have called *nigre*, is left at the bottom, perfectly distinct from the soap. When the soap is of a proper consistency for caking, it is transferred to the moulds, where it is treated in a manner similar to that already described in the white soap.

It is a question, whether making this inferior soap is so profitable to the manufacturer as is supposed. It has appeared, that in making the quantity of soap above stated, which is 26 cwt. 0 qr. 21 lbs., there are 5 cwt. 3 qr. 4 lbs. of refuse, which is principally in the *nigre*. This refuse will be found very trifling in the white soap; we think not more than $\frac{1}{17}$ th of the weight of the soap. It will be evident, that in making the yellow soap, a great quantity of matter is used which never combines. Would it not be more economical to purify these materials before hand?

Soft Soap.—This differs in its composition from hard, containing no alkali, but potash. We have seen that hard soap may be made not only with pure soda, as is the case in the manufactories in the south of France, but that a tolerably hard soap, much better fitted for practice, is made with about equal portions of potash and soda.

Soft soap made with colourless fat, such as tallow, is a white unctuous substance, about the consistency of lard. If the fat be coloured, the soap partakes of the same. In France and other parts of the continent, it is generally coloured, sometimes with metallic oxyds. Those made with yellow oil are sometimes coloured with indigo, which gives them a green colour. The oils employed are seldom olive-oil, but the cheaper oils, such as rape-oil, the oil of hempseed, lint-feed, and others.

In Holland it was made with whale-oil. This oil was forbidden on some parts of the continent, on account of its disagreeable smell. In this country, however, all the soft soaps are made with whale-oil, which gives a transparent mass of a yellow colour. In commerce, however, we do not find it uniform in its colour. Besides the yellow part, it appears interspersed with white spots, giving the whole a strong resemblance to the inside of a dried fig.

The proportions of potash and oil, for forming soft soap, will be easily inferred from what has been observed in the proportions of the other soaps. The white specks are produced by adding a portion of tallow to the oil, when the boiler is charged. This addition does not improve the soap, but habit in commerce has rendered it indispensable. The ley is prepared by adding to the potash about three-fourths its weight of quicklime, and the process is continued as directed in making the hard soap, using the same apparatus. The ley, when prepared, is to be added to the oil and tallow in the boiler at intervals, similar to those in making the hard soap, and the stirring kept up in the same way, till the mass assumes a proper consistency. The experienced soap-maker will judge, when the materials are in proper proportions, by the appearance of the soap when boiling; hence he knows when to cease to add more ley. Should a stranger to the process of making either kind of soap have to perform the task, he would require to know the proportions in which the alkali ought to bear to the oil. He would weigh his oil or tallow when he put it into the boiler; he will assay his ley by the method laid down in the commencement of this article, and by that means know how much real alkali is contained in a given measure of his ley. He will by this means know nearly when he had added a sufficient quantity of ley to saturate the oil or fat. In the soap made with soda, the real alkali must be to the oil as 1 to 7.28, and that with all potash must be as 1 to 5.1 nearly. This of course will be the proportion for soft soap. When the soft soap is

of a proper consistency for caking, it is poured into barrels, in which it is sold.

Soaps, particularly the hard, are frequently reduced in their value, by the fraudulent practice of keeping them wet. The common or proper state is when they contain about 30 *per cent.* of water; but they may, by a nefarious management, be made to contain 60 *per cent.* which is a great imposition. This fraud, like many others, is detected when it is too late. It is found to lose weight rapidly by exposure to the air.

Before we close this article, we may point out some means of economizing the use of the alkali in soap-making, which, in very extensive manufactories, is worth attending to. In the first place, it should be observed, that the spent leys always contain free alkali, and it is generally added a second time, in order that as much as possible of it may be taken up. It is found, however, by experience, that some will still be found in solution, which the fat will never take up. This is owing to the same liquid containing several neutral salts in solution. If this liquor be evaporated to a certain extent, and set to cool in shallow vessels, the neutral salts will crystallize and separate from the liquid to a certain extent. The liquid part may then be evaporated a second time, and again crystallized. The liquid, after these salts have been separated, may now be added to the fat, and the alkali will combine with it. If barilla or kelp is the alkali, then the liquid ought to have a little lime added, which evaporating, serves to take the carbonic acid from the soda. Without this precaution the carbonate of soda would crystallize with the other salts. With potash this precaution is unnecessary.

The salts which are separated from barilla and kelp are chiefly muriate and sulphate of soda. The former may be used as a substitute for salt in the last part of the process of boiling. The sulphate of soda may be fused with sawdust or powdered coal in a reverberatory-furnace. The sulphuret of soda is produced, from which the alkali may be recovered. Perfumed soaps are easily formed by adding the different essential oils while the soap is in a liquid form, but not while very hot, because the perfume would evaporate. The saponaceous liquid, called milk of roses, is formed by mixing the liquid obtained by exposing potash to the air with rose-water, and then adding this to oil of almonds, till the mixture becomes milky without being greasy.

Ball Soap, commonly used in the North, is made with lees from ashes and tallow. The lees are put into the copper, and boiled till the watery part is quite gone, and there remains nothing in the copper but a sort of saline matter (the very strength or essence of the ley); to this the tallow is put, and the copper is kept boiling and stirring for above half an hour, in which time the soap is made; and then it is put out of the copper into tubs, or baskets, with sheets in them, and immediately (while soft) made into balls. Note, it requires nearly twenty-four hours, in this process, to boil away the watery part of the ley.

The simplest, and upon the whole the most beautiful, soap, is the fine white soap prepared from olive-oil and soda, extracted from the best barilla, which is manufactured largely in the countries where the olive grows; particularly in the south of France, for which Marseilles is the most celebrated, in some parts of Italy, and in Tripoli. A similar, but more expensive soap, is made of soda and oil of almonds for medicinal purposes. (See *SAPO Amygdalinus.*) What is called in our country "Windfor soap" is of this kind, prepared with either of the above-mentioned oils. Common soap is manufactured principally by our soap-boilers from tallow or any other fat; and the alkali em-

ployed is either barilla or pearl-ash, or a mixture of the two, according to the price and the practice of the manufacturer. But in order to obtain a stiff salt, recourse is had to the action of common salt, as we have already mentioned. The olive-oil, or Marseilles and other soaps, are sometimes artistically "marbled," or streaked throughout their whole substance with red or blue veins. This soap is harder than the white soap of the same materials, because it requires to be dried to a greater degree in order to take the marbling. This is performed, by adding to the soap, as soon as it is completely made and separated from the spent ley, a fresh quantity of ley, and immediately afterwards a solution of sulphate of iron. A decomposition between the two takes place, and a black oxyd of iron is separated, which is entangled within the liquid soap. The boiler is then cooled, and the ley which settles is drawn off; after which the soap is again melted. A workman then stands over the boiler, and stirs the soap with a wooden instrument, while another throws in at intervals a quantity of colcothar, or brown-red oxyd of iron, ground up with water into a uniform liquid. This diffuses both the oxyds through the soap, which is then cooled and framed. This process requires some manual dexterity, so that the ingredients may be stirred together, and the marbling sufficiently diffused through the whole mass, without mixing it completely.

Soap is much used in washing and whitening linens, cleansing woollen cloths from oil, whitening silk, and freeing it from the resinous varnish with which it is naturally covered; and for various other purposes, by the dyers, perfumers, hatters, fullers, &c.

The alkaline lixiviums, being capable of dissolving oils more effectually than soap, might be employed for the same purposes; but when this activity is not mitigated by oil, as it is in soap, they are capable of altering, and even destroying entirely, by their causticity, most substances, especially animal matters, as silk, wool, and others; whereas soap cleanses from oil almost as effectually as pure alkali, without danger of altering or destroying, which renders it very useful.

The manufacture of soap in London, first began in the year 1524; before which time this city was served with white soap from foreign countries, and with grey soap, speckled with white, from Bristol, and sold for a penny a pound, and also black soap for a halfpenny the pound.

SOAP, in the *Materia Medica*. Soaps, both hard and soft, have been applied to medical use. Well made hard soap, fit for medical use, has very little odour, and a nauseous alkalescent taste; is white, and of a firm consistency; does not feel greasy, and is devoid of any saline efflorescence on the surface. With water it forms a milky opaque solution; and with alcohol a nearly transparent, somewhat gelatinous, solution. It is decomposed by all the acids, and by many neutral salts, which combine with the alkali and form new compounds; hence hard water which contains sulphate of lime does not properly dissolve soap. According to the experiments of Darcet, Lelievre, and Pelletier, (stated in the preceding article,) 100 parts of newly made soap consist of 60.94 oil, 8.56 alkali, and 0.503 water: but part of the water is lost by keeping, and the soap becomes lighter.

Hard soap, triturated with vegetable resins and thick balsams, incorporates with them into a compound; soluble, like the soap itself, in watery liquors; hence it proves an useful ingredient in resinous pills, which of themselves are apt to pass entire through the intestines, but by the admixture of soap become dissoluble in the stomach. It renders unctuous

unctuous and thick animal matters dissoluble in like manner in aqueous fluids, and hence may be presumed to act as a menstruum for these kinds of substances in the body, that is, to attenuate viscid juices and resolve obstructions: such, in effect, are the virtues which it appears to exert in cachectic, hydroptic, and icteric cases, in which last, particularly, its aperient and resolvent powers have been often experienced. Solutions of it have been likewise found to dissolve certain animal concretions of the harder kind, as the filaments which are sometimes seen floating in the urine of rheumatic and arthritic persons, the matter secreted in gouty joints, and the more compact urinary calculus; on these substances (at least in the latter), though soap of itself acts more languidly than lime-water, yet, when joined to that menstruum, it remarkably increases its activity; the dissolving power of a composition of the two being, according to Dr. Whytt's experiments, considerably greater than that of the soap and lime-water unmixed: of the good effects of these medicines in calculous cases there are several instances; but what their effects may be in gouty and rheumatic ones is not yet well known. See LITHONTRIPTICS, STEPHENS'S *Medicine*, &c. and STONE.

Soap is regarded, in the materia medica, as purgative and lithontriptic; externally applied it is stimulant and detergent. For internal use the hard soap only is employed. It is occasionally ordered in habitual costiveness, and in jaundice, combined with rhubarb, or some bitter extract; but its power as a purgative is very limited, and it cannot act in any other way in relieving jaundice. It is more useful in calculous habits, in which, however, its action is altogether confined to the stomach; for as soap is decomposed by the weakest acids, its alkaline base corrects the acidity so prevalent in the stomachs of calculous patients, and thus at least assists in checking the increase of the disease. Soap is also beneficial in decomposing metallic poisons when taken into the stomach; and, as it is the antidote which can most readily be procured, should always be early resorted to. It is necessary in this latter case to give it in solution; of which a teacupful should be drunk at short intervals, till the effects expected from it be produced. In other cases it is preferable to give it in substance. The dose may be from grs. v to ʒs, made into pills.

As an external remedy, soap is efficaciously used in frictions to sprains and bruises; and much benefit has been derived from rubbing the tumid bellies of children labouring under mesenteric fever, with a strong lather of soap every morning and evening.

From the properties of soap we may know, that it must be a very effectual and convenient anti-acid. It absorbs acids as powerfully as pure alkalies and absorbent earths, without having the causticity of the former, and without oppressing the stomach by its weight, like the latter. Soap is also one of the best antidotes to stop quickly, and with the least inconvenience, the bad effects of acid corrosive poisons, as aqua fortis, corrosive sublimate, &c.

Soap is employed externally for discussing rheumatic pains, arthritic tumours, the humours stagnating after sprains, &c. Some pretend that the indurated tophaceous concretions in arthritic joints, have been resolved by the external use of soapy cataplasms. Several compositions for external purposes are prepared in the shops.

The official preparations of soap are as follow: *viz.* "Pills of soap with opium," of Lond. Ph.; "Pills of compound squill;" "Aloetic pills" of Ed. Ph.; "Pills of aloes and assafoetida." (See PILLS.) "Pills of aloes and ginger," of the Dub. Ph. are compounded of ʒi. of hepatic aloes, ʒi. dr. of ginger-root in powder, ʒi. oz.

of soap, and ½ dr. of essential oil of peppermint: let the aloes and ginger be rubbed together to a powder; then add the soap and the oil so as to form a mass. This is an useful pill, and used with advantage for obviating the habitual costiveness of the sedentary, and of leucophlegmatic habits. The dose is from grs. x to grs. xv, or more:—"Soap plaster." (See EMPLASTRUM Saponis, and SOAP PLASTER.) "Cerate of soap," of the Lond. Ph. is composed of 8 oz. of hard soap, 10 oz. of yellow wax, 1 lb. of semivitreous oxyd of lead powdered, a pint of olive-oil, and a gallon of vinegar. Boil the vinegar on the oxyd of lead over a slow fire, stirring diligently till they incorporate; then add the soap, and boil again in a similar manner, until the moisture be entirely evaporated; and, lastly, mix with the oil the wax previously melted. This cerate is occasionally used as a cooling dressing. For the "compound soap liniment" of the Lond. Ph. see LINIMENT. The "Tincture of soap," commonly called "Liniment of soap," of the Ed. Ph., is prepared by digesting 4 oz. of soap sliced in 2 lbs. of alcohol for three days, and then adding 2 oz. of camphor, and ½ oz. of the volatile oil of rosemary, frequently shaking the mixture. These preparations are stimulant and anodyne, and may be beneficially applied against local pains, and in bruises, rubbed upon the parts. "The tincture of soap and opium" of Ed. Ph., commonly called "Anodyne liniment," is made in the same manner, and from the same ingredients as the other tincture of soap, only adding, at the beginning of the process, one ounce of opium. The addition of the opium to the soap liniment renders it, in many cases of rheumatism and local pains, more useful than the simple liniment.

The anodyne balsam, commonly called Bates's balsam, is prepared by digesting two ounces of soap and half an ounce of opium, in a gentle sand-heat, for three days, with eighteen ounces of rectified spirit of wine, and then adding six drachms of camphor and one drachm of oil of rosemary to the strained liquor. This composition, with the addition of opium, is supposed to be more effectual for allaying violent pains than the common opodeldoc: it is also given internally in nervous colics, jaundices, &c.

Soft soap is considerably more acrid than the hard soap, and it is, therefore, employed only for some external purposes: a mixture of equal parts of our common soft soap and quicklime is used as a mild caustic. Lewis's *Mat. Med.* Thomson's *Lond. Disp.*

SOAP, *Almond.* See SAPO *Amygdalinus*, and SOAP, *supra.*

SOAP, *Ammoniacal*, a white saponaceous compound, readily made by shaking any oil with liquid ammonia, which is much used medicinally as a stimulating application; but the union between these two is much weaker than between the fixed alkalies and oil, so that this will not harden; and by keeping for some time, the ingredients will partly separate. In order to effect a more intimate union between them, muriated ammonia must be added to common soap.

SOAP-LEES. See LIXIVIUM *Saponarium*.

The term *soap-les* is sometimes used technically to denote the "spent ley," which is pumped out of the vat or cistern, after the soap has separated; and which, being more or less alkaline, is reserved either to be used again, or to be evaporated, so that the residue may be calcined for extracting the alkali.

SOAP, *Starkey's*, is a combination of fixed vegetable alkali with essential oil of turpentine. It is so called from its inventor, who combined salt of tartar (carbonate of potash) with this oil, and obtained a saponaceous compound, to

which many medicinal virtues have been ascribed. It enters also into the composition of pills, named also from Starkey. As fixed alkalies are very difficultly made to unite with essential oils, Starkey found no other expedient for the preparation of his soap, than time and patience. His method consists in putting dry alkali into a matras, and pouring upon it essential oil of turpentine to a height equal to the breadth of two or three fingers: in five or six months part of the alkali and oil will be thus combined together, and form a soap, which must be separated from the mixture, and more of it will be afterwards formed in the same manner. The most commodious method, says Dr. Lewis, of obtaining the combination, is by throwing the salt, red-hot, into a heated mortar, immediately reducing it to powder; then pouring on it, whilst hot, by little at a time, an equal quantity, or more, of the oil, and continuing to grind them together, so as to form a smooth soft mass. Stahl, Rouelle, Beaumé, &c. have published processes for this combination. Mr. Beaumé says, that it may be made in a few hours by triturating, during a long time, alkaline salt upon a porphyry, and adding to this salt, during the trituration, oil of turpentine. This medicine, which has an acrid alkaline taste, and is very apt to deliquate on being exposed to air, was formerly celebrated, under the denomination of soap of tartar, universal corrector, &c. as a diuretic in nephritic complaints, and as a corrector of certain vegetables, particularly of opium: its virtues have not been fully determined by experience, nor does the present practice pay any regard to it.

SOAP, *Volatile*, is of three kinds, viz. one composed of fixed alkalies and volatile oils; another of volatile alkalies and oils of the grosser or more fixed kind; and the third, in which both the alkali and the oil are volatile. Of the first kind is Starkey's soap: those of the second sort are obtained more readily. (See *LINIMENTUM Volatile*, and *EPITHEM Volatile*.) Combinations of the latter kind, in a liquid form, have been described under *SALTS*; and compositions of the same kinds may be obtained in a solid state, by mixing the salt with the oil, and subliming them together.

SOAP, *Laws relating to*. By 17 Geo. III. c. 52. no person, within the limits of the head office of excise in London, shall be permitted to make any soap, unless he occupy a tenement of 10*l.* a year, and be assessed to, and pay the parish rates; or elsewhere, unless he be assessed to, and pay to church and poor. By 24 Geo. III. c. 41. and 43 Geo. III. c. 69. every soap-maker shall annually take out a licence, for which he shall pay 2*l.* By 43 Geo. III. c. 68. sched. (A), certain duties are laid on soap imported, as therein stated; and upon the exportation of soap made in Great Britain, and which hath paid the duties, the same shall be drawn back, by 43 Geo. III. c. 69. sched. (C): but no drawback shall be allowed on the exportation of foreign soap imported. (27 Geo. II. c. 21.) By 43 Geo. III. c. 69. sched. (A), certain duties are imposed on soap made in Great Britain; and certain allowances shall be made for soap used in the manufactures of Great Britain, sched. (C). Places of making are to be entered on pain of 200*l.* (10 Ann. c. 19. 47 Geo. III. sess. 2. c. 30.); and covers and locks to be provided under a forfeiture of 100*l.* (5 Geo. III. c. 43. 12 Geo. III. c. 40.) The furnace-door of every utensil used in the manufacture of soap shall be locked by the excise officer, as soon as the fire is damped or drawn out, and fastenings provided; and opening or damaging such fastening incurs a penalty of 100*l.* (17 Geo. III. c. 52. 24 Geo. III. c. 48. sess. 2.) Officers are required to enter and survey at all times, by day or night, and the penalty of obstructing is 50*l.*; and they

may unlock and examine every copper, &c. between the hours of five in the morning and eleven in the evening, and the penalty of obstructing is 100*l.* No soap-maker shall have any private pipe or conveyance, on pain of 200*l.*; and the penalty of obstructing an officer who searches for it is 100*l.* No maker shall have more than one moveable pump, on penalty of 500*l.* Every maker of soap, before he begins any making, if within the bills of mortality, shall give twelve hours, if elsewhere, twenty-four hours' notice, in writing, to the officer, of the time when he intends to begin, on pain of 100*l.* No maker shall remove any soap unfurveyed, on pain of 20*l.*, without giving proper notice of his intention. And if any maker shall conceal any soap or materials, he shall forfeit the same, and also 500*l.* (1 Geo. III. stat. 2. c. 36.) And the penalty of privately making soap is forfeiture of the soap and materials, and 100*l.* (5 Geo. III. c. 43.) Persons assisting in making soap privately shall forfeit, for the first offence, 20*l.*; for the second, 40*l.* or be liable to four months' imprisonment till it be paid. (47 Geo. III. sess. 2. c. 30.) Owners or renters of houses where soap shall be privately made forfeit 200*l.* Every barrel of soap shall contain 256 lbs. avoirdupois, half-barrel 128 lbs., firkin 64 lbs., half-firkin 32 lbs., besides the weight or tare of each cask; and all soap, excepting hard cake soap and ball soap, shall be put into such casks and no other, on pain of forfeiture and 5*l.* (10 Ann. c. 19. 12 Ann. st. 2. c. 9.) The maker shall weekly enter in writing at the next office the soap made by him in each week, with the weight and quantity at each boiling, on pain of 50*l.*; and within one week after entry clear off the duties, on pain of double duty. (17 Geo. III. c. 52.) Cockets granted for shipping soap to be conveyed to any other part of the kingdom, shall express the quality, quantity, and weight, the mark of the package, by whom made and sold, and where consigned, under penalty of forfeiture and seizure of the same and package. (23 Geo. II. c. 21.) No soap shall be imported, otherwise than in some package, containing at least 224 pounds of hard soap, on pain of seizure and forfeiture, and also package; and the master of the vessel shall forfeit 50*l.* If any person shall knowingly harbour or conceal any soap, unlawfully imported, or reloaded after shipping for exportation upon debenture, he shall forfeit 50*l.* for every hundred weight, together with the goods and package. The maker shall keep just scales and weights, where he makes his soap, and permit and assist the officer to use them, on pain of 10*l.* (10 Ann. c. 19.) And by 10 Geo. III. c. 44. for insufficient scales and weights, he shall forfeit 100*l.*

SOAP-*Ashes*, in *Agriculture*, the refuse of soap-boilers, sometimes termed soapers' ashes. See *ASHES*.

SOAP *Refuse*, the compounds of oil, tallow, and other substances, with lime and pot-ash, which are often met with and used as manures. Most sorts of soapy mixtures are found to have much effect in promoting vegetation.

Soap-suds, or the washings of this sort which are left and thrown away from large mills and manufactories, such as those of the silk and other similar kinds, are found highly beneficial as manures themselves, or for being mixed and blended up with other matters in this intention. The farmers, in some places, collect them by the hoghead, at the rate of from 6*d.* to 1*s.*, and mix them up with earthy materials, so as to form rich composts, in consequence of their containing portions of animal matter, gum, and alkali, especially when taken from silk works. And the common soap-suds, which are generally wasted and thrown away, are said to have been found of great utility in cold moist meadows; and would probably be more so, if employed in combination

bination with rich earthy substances. All the various refuse matters of this sort should be collected, as they are capable of being used in this way with advantage to the farmer. See *SALINE Manures*.

SOAP-Stone, in *Mineralogy*, a variety of steatite. (See *STEATITE*.) The name is derived from the colour, and the peculiar unctuous feel, which resembles that of white soap. It is sometimes striped and mottled with veins and spots of a dull purple. When first quarried it is very soft, and yields to the nail; but gradually grows harder by exposure to the air, though it never loses the soapy feel by which it is characterized. The only part of England where soap-stone is procured is at the promontory of the Lizard, in Cornwall: it occurs in veins in serpentine, to which rock it seems nearly allied. A large quantity of this stone is used in the china manufacture at Worcester. Its value arises from its great infusibility, and its property of preserving its whiteness in the furnace. The former it derives from the absence of lime, or the alkalis; the latter from the absence of metallic matter, of which a very small portion only can be traced by chemical analysis. The fracture of soap-stone is uneven and splintery; it is translucent in minute fragments; it cracks and falls to powder in hot water.

SOAP-Earth, Smyrna. See *FLOS Afiz*, *NATRON*, and *SAPONACEA Terra*.

SOAPBERRY-TREE, in *Botany*. See *SAPINDUS*.

The skin or pulp of the berries of the soapberry-tree is used as soap: they are of the size of a musket-ball, with winged leaves, and are used in washing without any admixture of salt or oil. They perform the office of soap very well, as to the cleansing of the linen, but being of a very acid nature, they rot it in time.

The Negroes in general use them for their coarse apparel, which bears them much better than the finer linen worn by the Europeans.

It is said, that this fruit is a medicine of singular and specific virtue in chloroses, and that a tincture or extract is preferable to the berry in substance; whence it may be presumed, that the soapy matter is dissoluble in spirit. Its medicinal virtue was first published by Marloe, in a letter to Mr. Boyle; but it is unknown in practice, and in the shops. Lewis.

SOAPERS' WASTE, in *Agriculture*, the waste materials of soap manufactories, and of other places where works of this nature are carried on, which are useful as manure. These waste matters have been recommended in this intention, mostly on the supposition, that their effects principally depended upon the different saline matters which they contained; but it has been found, that the quantity of such substances in them is very small indeed, and that it principally consists of mild lime and quicklime. It is said that lime, when made wet with salt-water, yields more of this waste than in other cases, and is capable of being employed as manure, in certain cases, with greater benefit than that of lime in its ordinary state. This is a material which is very extensively made use of in some districts.

SOAPEY ROCK, in *Geography*, a rock in the English Channel, close to the Cornish coast; 4 miles N.W. of Lizard Point.

SOAPWORT, in *Botany*, &c. See *SAPONARIA*.

SOAR, or *Sour*, anciently *Leire*, in *Geography*, a river of England, which rises about five miles from Lutterworth, passes by Leicester, &c. and runs into the Trent on the borders of Nottinghamshire, about three miles N.N.E. of Kegworth.

SOAR, a fort of Hindoostan, in Bahar; 23 miles N. of Durbunga. N. lat. $26^{\circ} 30'$. E. long. $86^{\circ} 5'$.

SOAR-Hawk. See *FALCON*.

SOARA, in *Ancient Geography*, a river of India, on this side of the Ganges. Ptolemy.

SOASTUS, a river of India, which ran into the Cophas, according to Arrian.

SOATRIS, a town of Lower Mæsia, upon the Euxine sea, between Marcianopolis and Anchiale, according to the Itinerary of Antonine.

SOATTO. See *SOAGGIO*.

SOAVE, Ital. was a musical term, formerly, for singing or playing in a sweet and pleasing manner; but *dolce* has long supplied its place; which see.

SOAVO, in *Geography*, a town of Italy, in the Veronese; 10 miles E. of Verona.

SOAY, a small island on the coast of Sutherlandshire, near the entrance of Loch Inver. It affords good pasturage for sheep. N. lat. $56^{\circ} 29'$. W. long. $6^{\circ} 27'$.

SOB, a river of Russia, which runs into the Oby; 32 miles S.W. of Obdorskoi.

SOBALA, in *Ancient Geography*, a town of Asia Minor, in Caria. Steph. Byz.

SOBALASSARA, a town of India, on this side of the Ganges, which Ptolemy attributes to the Caspiræi.

SOBANNUS, a river of India, on this side of the Ganges, the mouth of which is placed by Ptolemy between Pagrafa and Pithonobaste.

SOBATZ, in *Geography*, a town of Slavonia, on the river Save; 30 miles W.S.W. of Belgrade.

SOBERNHEIM, a town of France, in the department of the Rhine and Moselle; 10 miles W.S.W. of Creutznach. N. lat. $49^{\circ} 45'$. E. long. $7^{\circ} 45'$.

SOBHA, in *Hindoo Mythology*, is a personification of beauty, and the name of a nymph celebrated in the annals of the East for her amours with *Krishna*; which see. See also *RADHA*, for the translation of a passage wherein she is mentioned.

SOBIESKI'S SHIELD, in *Astronomy*. See *SCUTUM Sobieski*.

SOBIESKY, in *Biography*. See *JOHN*, king of Poland.

SOBIESLAU, in *Geography*, a town of Bohemia, in the circle of Bechin; 10 miles E. of Bechin. N. lat. $49^{\circ} 18'$. E. long. $14^{\circ} 34'$.

SOBINKA, a town of Bohemia, in the circle of Boleslau; 5 miles S.W. of Jung Buntzel.

SOBOTALE, in *Ancient Geography*, a town of Arabia Felix, which, according to Pliny, was the capital of the Atramites.

SOBOTKA, in *Geography*, a town of Bohemia, in the circle of Boleslau; 11 miles E.S.E. of Jung Buntzel. N. lat. $50^{\circ} 24'$. E. long. $15^{\circ} 11'$.

SOBRADA, a town of Spain, in Galicia; 9 miles E.S.E. of Lugo.

SOBRADILLO, a town of Spain, in the province of Leon; 24 miles N.N.W. of Ciudad Rodrigo.

SOBRALIA, in *Botany*, a genus dedicated, in the *Flora Peruviana*, p. 109, to the honour of Don Francis Martin Sobral, a distinguished Spanish botanist. *De Theis*.

SOBRARVA, in *Geography*, a district and principality of Spain, included in Aragon, W. of Ribagorga, anciently a small kingdom.

SOBRE BUENA, a name given by the Spaniards in America to a species of vanilla, which is greatly superior to all the other kinds.

The pods of this are of the same shape with those of the common vanilla, but are nearly twice as large. A bundle of about fifty of these usually weighs five ounces, and such a bundle of the sibre buena kind often weighs eight. These are full of a blackish balsamic liquor, in which are contained a number of small seeds.

SOBREYRA, in *Botany*, a genus named in honour of John Sobreyra, a Spanish monk and a naturalist. *De Theis*.

SOC, **SOK**, or *Soka*, in *Law*, denotes jurisdiction; or a power or privilege to administer justice, and execute laws.

The word is also used for the shire, circuit, or territory, in which such power is exercised by him endued with such jurisdiction.

Hence, also, the law Latin *foca*, used for a feignory or lordship enfranchised by the king, with liberty of holding a court of his *soc-men* or *socagers*, that is, his tenants; whose tenure is hence called *focage*.

This kind of liberty still subsists in several parts of England, under the name of *foke* or *foken*. Skene defines *foce* to be, *señal de hominibus suis in curia secundum consuetudinem regni*. Brady makes mention of these liberties: *soc, sac, tol, team, insangthes*, and *usangthes*.

In the laws of Henry I. *foca* is also used as synonymous with franchise, for a privileged place, refuge, asylum, or sanctuary, &c. from the Saxon *foen*, or *foene*.

SOCAGE, or **SOCCAGE**, in its most extensive signification, seems to denote a tenure by any certain and determinate service. And thus, our ancient writers constantly put it in opposition to chivalry, or knight-service, where the render was uncertain.

Thus Bracton, if a man holds by a rent in money, without any escheage or serjeanty, *id tenementum dici potest focagium*. Littleton also defines it to be, where the tenant holds his tenement of the lord by any certain service in lieu of all other services, so that they be not services of chivalry, or knight-service: therefore, he tells us, that whatsoever is not tenure of chivalry is tenure in focage. The service must therefore be certain, in order to denominate it focage; as to hold by fealty and 20s. rent; or by homage, fealty, and 20s. rent; or by homage and fealty, without rent; or by fealty and certain corporal services, as ploughing the lord's land for three days; or by fealty only, without any other service; for all these are tenures in focage.

Socage is of two sorts; *viz.* *free focage*, where the services are not only certain but honourable; and *villein focage*, where the services, though certain, are of a baser nature. See **VILLENAGE**.

Such as hold by the former tenure are called, in Glanvil, and other subsequent authors, by the name of *liberi fokemanni*, or tenants in free focage. This, in the nature of its service, and the fruits and consequences appertaining to it, was always much the most free and independent species of any. On this account, the learned judge Blackstone assents to Mr. Somner's etymology of the word; who derives it from the Saxon appellation *foce*, which signifies *liberty* or *privilege*, and, being joined to a usual termination, is called *focage*, signifying by it a free or privileged tenure. This etymology, he says, seems to be much more just than that of our common lawyers in general, who derive it from *foca*, a *plough*; because in ancient time their focage-tenure consisted in nothing else, but services of husbandry, which the tenant was bound to do to his lord, as to plough, sow, or reap for him; but that in process of time, this service was changed into an annual rent by consent of all parties,

and that, in reference to its original, it still retains the name of focage, or plough-service. But this by no means agrees with what Littleton himself tells us, that to hold by fealty only, without paying any rent, is tenure in focage; for here is plainly no commutation for plough-service. Besides, even services, confessedly of a military nature and original, the instant they were reduced to a certainty, changed both their name and nature, and were called focage. It was the *certainty*, therefore, that denominated it a focage-tenure; and nothing surely could be a greater liberty or privilege, than to have the service ascertained, and not left to the arbitrary calls of the lord, as in the tenure of chivalry. Wherefore also Britton, who describes focage-tenure under the name of *fraunke ferme*, tells us, that they are lands and tenements, of which the nature of the fee is changed by feoffment out of chivalry for certain yearly services, and in respect of which, neither homage, ward, marriage, nor relief, can be demanded. Moreover, if focage-tenures were of such base and servile original, it is hard to account for the very great immunities, which the tenants of them always enjoyed; so highly superior to those of the tenants by chivalry, that it was thought, in the reigns of both Edward I. and Charles II. a point of the utmost importance and value to the tenants, to reduce the tenants by knight-service to *fraunke ferme*, or tenure by focage. It seems probable, therefore, that the focage-tenures were the relics of Saxon liberty, retained by such persons as had neither forfeited them to the king, nor been obliged to exchange their tenure for the more honourable, as it was called, but at the same time more burthensome tenure of knight-service. This is peculiarly remarkable in the tenure called gavel-kind, which is generally acknowledged to be a species of focage-tenure; the preservation of which inviolate from the innovations of the Norman conqueror, is a fact universally known. And those who thus preferred their liberties were said to hold in *free* and *common* focage. This tenure will, therefore, include all other methods of holding free-lands by certain and invariable rents and duties; and, in particular, petit serjeanty, tenure in burgage, and gavel-kind. Blackst. Comm. book ii. cap. 6. Lord Littleton's Hist. of Hen. II. vol. iii. p. 158. 8vo.

Skene defines *focage*, a tenure of lands, by which a man is infeoffed freely, without wardship and marriage, paying to his lord some small rents, &c. which is called *free focage*, &c. Several divisions of focage are met with in law-writers, as *focage in capite*, &c. But by stat. 12 Car. II. it is ordained, that all tenures from and after the 24th of February, 1645, shall be adjudged and taken for ever, to be turned into free and common focage.

SOCAGE, *Guardian in*. See **GUARDIAN**.

SOCAGERS, in our *Old Writers*, such tenants as held by the tenure called *focage*. They were otherwise called *soc-men*.

SOCANDAGO, in *Geography*. See **SAGENDAGO**.

SOCCELLI, among the *Romans*, were swaths or bands, which covered the leg down to the foccus.

SOCCUS, **SOCK**, in *Antiquity*, a kind of high shoe, reaching above the ankle, worn by the actors in the ancient drama, in the representation of comic characters.

The foccus was much lower than the cothurnus, and was the distinguishing wear of the comedians; as the cothurnus was of the tragedians; hence foccus is frequently used for comedy itself. Comedy, says M. Fenelon, must talk in a humbler style than tragedy; the sock is lower than the buskin.

SOCCUS, in *Botany*. See **ARTOCARPUS**.

SOCERGA,

SOCERGA, in *Geography*, a town of Istria; 7 miles S.E. of Capo d'Istria.

SOCHAN. See **ZACHAN**.

SOCHATSCHOW, a town of the duchy of Warfaw; 30 miles N. of Rava.

SOCHIAVO, a town of Italy, in the Bellunese; 5 miles W. of Belluno.

SOCHOS, in *Ancient Geography*, a town of Asia, in Syria, situated on the bank of the river Singas, in the southern part of the town of Samosata.

SOCIAL WAR, in *Roman History*, commenced A.U.C. 663, on the following occasion. M. Livius Drusus, tribune of the people, influenced by a view to the public welfare, formed a scheme to reconcile all orders of men, and put an end to all discontents, which he foresaw would in process of time, if not removed, produce a general insurrection. With this view he proposed a law for investing the Italian allies with all the privileges of Roman citizens. They remonstrated that they paid considerable taxes; that, in time of war, their countries raised double the number of forces that were raised in Rome; that the commonwealth owed greatly to their valour that prodigious power which she had acquired; and that it was but just they should share the honour of a state, which they had helped to aggrandize both with their arms and treasures. But this law of Drusus in their favour was opposed with great violence, not only by the senators and knights, but even by the people, who could not bear the thoughts of making those their fellow-citizens, whom they looked upon as their subjects. In the mean time the Italian allies flocked to Rome from all parts to support their protector, and determined to effect by force what they could not gain by favour. The death of Drusus, who was basely assassinated for attempting to procure for them the right of citizenship, provoked the allies to such a degree, that they recurred to arms, in order to do themselves justice. The Marsi, Peligni, Samnites, Campanians, and Lucanians, and in short all the provinces from the Liris to the Adriatic, revolted at once. Rome had never engaged more formidable enemies. As they had all served in the same armies of the republic, they were as well disciplined as her legions, and their leaders had learned the art of war under her most famous commanders. It is said of the Marsi in particular, that Rome had never gained a victory in which they had not a great share. The first step they took in their revolt, was to erect themselves into a republic in opposition to that of Rome. After many alternate successes and defeats, the consul, Julius Cæsar, desirous to put an end to the war, drew up a law, which was confirmed by the senate, and enacted, that all the nations in Italy, whose alliance with Rome was indisputable, should enjoy the rights of Roman citizens. This law, called the Julian law, much abated the ardour of the enemy, and drew off several nations from the confederacy. The tribune, M. Plautius Sylvanus, in conjunction with Caius Papirius Carbo, one of his colleagues, put the last hand to the Julian law in favour of the allies, and got it confirmed by the people, and published in the following words: all the citizens of the allied cities, who shall be in Italy at the time of the promulgation of this law, shall be deemed citizens of Rome, provided they register their names with one of the three prætors within sixty days. This brought the Italians to Rome in such numbers, that the new citizens became more numerous than the old; but, lest this should make strangers matters of the elections, and consequently of the republic, the censors did not incorporate them in the thirty-five Roman tribes, but formed them into new tribes, who were to vote last. By this means all matters were determined by a majority of voices, before the new

tribes gave their suffrages. The allies were sensible of this artifice, but dissembled their dissatisfaction, being resolved, when an opportunity offered, to put themselves upon a level with the old inhabitants of Rome. The tribune, Sulpicius, proposed a law, that all the inhabitants of Italy, who had lately obtained the right of citizenship, should be incorporated into thirty-five tribes, and consequently have the same right of voting, each in his tribe, as others had, without any distinction, and got it passed. But when Sylla prevailed, all the laws of Sulpicius were declared void and null.

SOCIETY, **SOCIETAS**, an assemblage or union of several persons in the same place, for their mutual assistance, security, interest, or entertainment.

Societies of men united together to procure their mutual safety and advantage, by means of their union compose nations or states. Men are led to associate for this purpose by the affections and instincts implanted in their nature, and by the wants and weaknesses inseparable from the constitution of both their bodies and minds, and from the condition they are appointed to occupy. They also possess the faculties of reason and of speech, which render them capable of mutual intercourse for their mutual advantage. Hence we may deduce that natural society which is established among mankind; and the general law of this society is, that each should do for others whatever their necessities require, and they are capable of doing, without neglecting what they owe to themselves. This law ought to be observed by all the individuals of the human race, in order to live agreeably to their nature, and in conformity to the design of their common Creator: nor can it be neglected or violated, consistently with a due regard to our own safety and happiness.

Thus we see that the universal society of the human race is an institution of nature, and that it necessarily results from the nature of man: and, therefore, all men, whatsoever be their station, are obliged to cultivate and discharge its duties. They cannot dispense with it by any convention or private association. When they unite in civil society, in order to form a separate state, or nation, they may justly enter into particular engagements, towards those with whom they associate; but they are still under the obligation of performing their duty to the rest of the human species.

As the end of the natural society established between all mankind is that of their affording assistance towards their own perfection, as well as that of the state; and as the nations, considered as so many free persons who live together in a state of nature, are obliged to cultivate between each other this intercourse of humanity; the end of the great society established by nature between all nations is also a mutual assistance for the improvement of themselves and their state. Accordingly, the first general law which the very end of the society of nations discovers, is, that each nation ought to contribute all in its power to the happiness and perfection of others: but the duties which we owe to ourselves having a claim in our preference to those which are incumbent upon us with respect to others, a nation ought, in the first place, to do whatever it can to promote its own happiness and perfection. Moreover, as nations are free and independent of each other, in the same manner as men are naturally free and independent, the second general law of their society is, that such nation ought to be left in the peaceable enjoyment of that liberty which it has derived from nature. From this liberty and independence it follows, that every nation is to judge of what its conscience demands, of what it can or cannot do, of what is proper or improper to be done; and, consequently, to examine and determine whether it can perform any office for another, without

without being wanting in what it owes to itself. Since men are naturally equal, and their rights and obligations are the same, as equally proceeding from nature, nations composed of men considered as so many free persons, living together in a state of nature, are naturally equal, and receive from nature the same obligations and rights; and hence we conclude, that what is permitted to one nation is permitted to all, and what is not permitted to one is not permitted to any other. The effect of all this is the producing, at least externally, and among men, a perfect equality of rights between nations, in the administration of their affairs, and the pursuit of their pretensions, without regard to the intrinsic justice of their conduct, of which others have no right to form a definitive judgment; so that what is permitted in one is also permitted in the other; and they ought to be considered in human society as having an equal right. It is, therefore, necessary, on many occasions, that nations should suffer certain things to be done that are very unjust and blameable in their own nature, because they cannot oppose it by open force, without violating the liberty of some particular state, and destroying the foundation of natural society. The rules that flow from this principle form what Mr. Wolff calls "the voluntary law of nations." Hence it follows, that all nations have a right to repel by force what openly violates the law of the society which nature has established among them, or that directly attacks the welfare and safety of that society. At the same time, care must be taken not to extend this law to the prejudice of the liberty of nations. The general and common law of nations, with respect to the conduct of all sovereign states, ought to be measured by the end of the association that subsists between them. The several engagements into which nations may enter produce a new head of the law of nations, called "conventional," or "of treaties." Besides, certain maxims, and customs consecrated by long use, and observed by nations between each other as a kind of law, form the "customary law of nations," or, "the custom of nations." These three kinds of the law of nations, "voluntary," "conventional," and "customary," together compose the "positive law of nations." For they all proceed from the volition of nations; the "voluntary law," from their presumed consent; the "conventional law," from an express covenant; and the "customary law," from a tacit consent. See *LAW of Nations, STATE, and GOVERNMENT.*

Of societies we have a great many kinds, distinguished by the different ends proposed by them: *civil societies, trading societies, religious societies, literary societies, &c.*

SOCIETY, in *Trade*, is a contract or agreement between two or more persons, by which they bind themselves together for a certain time, and agree to share equally in the profits or losses which shall accrue in the affairs for which the society or copartnership is contracted.

We have several very considerable societies of this kind; as the Merchant Adventurers, the Turkey, East India, Muscovy, Eastland, Greenland, Spanish, African, South Sea, and Hudson's Bay, companies; the institutions, policies, &c. of which, see under the article *COMPANY.*

By the Roman law, the social contract needs no other solemnity but the sole consent of parties, without any writing at all; but among us, articles of copartnership are required. There is no contract in which probity is more required than in society; inasmuch as the laws pronounce those null that are made contrary to equity, and with design to deceive.

The French distinguish three kinds of mercantile society; *ordinary society*, called also *collective* and *general*; *society in commendam* or *commandity*; and *anonymous society*, called also *momentary* and *inconnué*.

The first is, where several merchants act alike in the affairs of the society, and do all under their collective names, which are public, and known to every body.

Society in commendam, &c. is that between two persons, one of whom only puts his money into stock, without doing any other office of a copartner; the other, who is called the *complementary* of the society, dispatching all the business under his own name.

Anonymous society, is that where all the members are employed, each particularly in the common interest, and each is accountable for profits, &c. to the rest, but without the public's being informed of them; so that the seller has only an action against the particular buyer, no other name appearing.

It is also called *momentary*, because frequently made on particular occasions, and ceasing with them: as in the making a purchase, selling any commodity, &c.

Of this they distinguish four kinds: *society by participation*, which is usually formed by letters from one city to another, where a merchandize is to be bought or sold. The second is, when two or three persons go together to fairs to buy goods. The third, when two or three persons agree to buy up the whole of some commodity in any country to sell it again at their own price. And the fourth is, when three or four persons make a journey together to buy and sell the same commodity. Beside merchants, people of quality, &c. are admitted into these anonymous societies.

SOCIETIES, *Religious*, are parties of persons formed either to live regularly together, or to promote the interest of religion, or to cultivate it in themselves.

Of the first kind are all congregations of religious; particularly the Jesuits (see *JESUITS*), who are called the society of Jesus; though they more usually call themselves the company of Jesus; the society of the Sorbonne; the society of St. Thomas de Villeneuve, instituted in 1660, by F. Ange le Proust; the society of St. Joseph, instituted in 1638; the society of Bretagne, a reform of Benedictines, in 1606; and the society of Jesus, a religious military order, instituted by Pius II.; the society of the Cord. See *CORD.*

Of the second kind are, the

SOCIETY for the Reformation of Manners, and putting in execution the laws against immorality and prophaneness. A society of this kind was set on foot about the time of the Revolution, by five or six private persons in London, and was afterwards exceedingly increased by a number of members of all denominations.

Societies for this purpose have been occasionally established, not only in London, but in other principal towns, in a later period.

SOCIETIES, *Friendly*. See *FRIENDLY Societies.*

SOCIETIES, *Friendly*, in reference to *Agriculture*, such as are established for the purpose of relieving the labouring classes during the periods of sickness, or when incapable of working. Many societies of this nature have been formed in different parts of the kingdom within these few years, with much success. And it has been remarked by Mr. Curwen, that to encourage the people to provide means of support for themselves, in cases of sickness and misfortune, is highly desirable, both as to the effect it produces in making them more respectable members of the community, and in exempting parishes from the most enormous weight of poor rates.

On this subject it has been suggested by a late writer, after observing that such establishments would certainly be attended with very beneficial consequences, that it might be highly proper to frame a law, whereby labourers of all descriptions should be *compelled* to assign a portion of the fruits

of their labour, during the time of their health and strength, for the establishing of a fund for their relief when overtaken by misfortunes. The forming of provident societies or clubs, by which, during the time the members are in health and the vigour of life, they may, by small constant weekly payments, make a suitable provision, from the produce of their own industry, against the period when sickness, misfortune, old age, or infirmity may reach them, is, he thinks, a measure which, the more it is known, the more it will meet with the approbation of the public. And though, by some, such societies may be thought very remotely, if at all, connected with the subject of agriculture; to the more intelligent, the best means of providing for the industrious peasantry, whose 'rough laborious hand' allows the wealthy to live in indolence and ease, will always be an interesting subject. The more so it must prove, as the suggesting of proper measures for that effect, if attended to, will infallibly remove, in a great degree, the load of poor rates, which hangs like a mill-stone about the neck of the English farmer; a load which, if effectual measures be not in a short time adopted to remove, must necessarily be attended with consequences of the most alarming nature, as its weight is increasing with such rapidity, that in a few years it must become altogether insupportable.

And it has been well remarked by Dr. Anderson, that friendly societies, voluntarily entered into by the industrious poor, have relieved many a worthy character in the time of their sickness, infirmities, misfortunes, and old age, in a more ample and comfortable manner than they would have been provided for by the parish levies. Why, he asks, may not all the poorer sort in their youth be compelled to provide, out of their industry, for their old age and infirmities? Why may not the poor of every parish be by law created into friendly societies? Suppose the master of every servant and labourer was obliged to retain, out of the wages of each, three-pence a-week, and pay the same in the respective names of such servants and labourers into the parish stock. When a servant or labourer removes from one parish to another, he might be entitled to a certificate from the parish he leaves, where he has drawn no pay of the amount of the sum total he has contributed; and when he has gained a settlement in another parish, that parish might be entitled to draw on the first for the money the pauper has paid; so that every man may draw his fortune after him, which may prevent many a litigation respecting the settlement of the poor, and be a great spur to industry.

In the rural economy of the west of England, it has been stated by Mr. Marshall, that several of these valuable institutions have existed in Devonshire for about thirty years; and that their good effects are so evident, that the encouragement of them ought to become a national object of the first magnitude; not more with a view to lessen the present heavy burdens of the poor rates, than to instil into the lower classes of society a principle of frugality, and a sense of social duties, which these meetings, under suitable regulations, cannot fail of producing.

The following is the plan laid down by Mr. Pew, who has paid much attention to the subject, and who observes, that if the collection of a small but voluntary tax upon the sober and industrious citizen, for his own use when in distress, be in some degree beneficial, he conceives that the collection of a still smaller, though compulsory, tax upon all ranks of men, the idle, the improvident, and the irresolute, as well as the industrious citizen, for the same purpose, would be a measure as much more beneficial as it is more extensive. This he conceives to be capable of being effected in this way. 1. That a proper officer be

appointed for such an extent of district as he may be supposed conveniently to superintend, to take a list of the names and places of abode of all males and females above the age of seventeen years, in the same manner as the list is made out for the militia. 2. That every such male pay two-pence *per week*, and every such female three farthings or one penny *per week*, into the hands of the above officer, for the purposes hereafter to be specified. 3. That the above officer shall be empowered to furnish employment for all such as are willing to work, and who cannot find it for themselves. Whether this officer should be chosen annually in rotation, after the manner of an overseer, or whether he should be a permanent officer upon an adequate salary, will be a matter of future consideration; but if the latter, he should be paid by the community and not out of the fund. 4. That all the poor being thus sure of employment, the master or mistress for whom they work should be justified in retaining these sums respectively out of their wages; and whether they do so or not, they should (in default of the individual) be answerable to the officer for its payment. All masters and mistresses of families should in like manner be answerable for their servants; and all keepers of lodgings, &c. for their inmates. 5. That these sums should be carried weekly to the general treasurer of the division, who should give sufficient security for the same. 6. That out of this fund every male who is really incapable of labour, should (by virtue of a certificate from the above officer) have a right to demand from the treasurer five shillings *per week* for the first six months, should his illness last so long, and four shillings *per week* after that period, until he again become capable of labour. And that every female should have a right to demand two shillings and six-pence *per week* for the first six months, and afterwards two shillings *per week*, until she be again able to work: she should also be entitled to four weeks full pay at every lying-in. Every male above the age of sixty-five years, whether capable of labour or not, should be entitled to four shillings *per week* during life. Every female, after the same age, two shillings. 7. Any person having three children under nine years of age, should be entitled to one shilling and six-pence *per week*, until the eldest should have attained the age of nine years; and if he has more than three under that age, he should be entitled to one shilling and six-pence *per week* for each above that number; and if any one or more of his children should happen to be idiotic, insane, or otherwise so far disabled, either in body or mind, as to be utterly incapable of labour, each of them should still be considered as under the age of nine years, and paid for accordingly.

If a mother should be left a widow, with three children under nine years of age, she should be entitled to receive five shillings; if with two children, three shillings; and if with one child, one shilling and six-pence *per week*; if with more than three under that age, one shilling *per week* for each above that number; it being admitted that all her time is taken up by three, and allowance made for it, but that she is capable of looking after, and taking care of, a greater number. The wives of men serving in the militia, and in the army or navy, should, during the absence of their husbands, be considered and provided for in all respects as widows.

If a child should be left an orphan, under nine years of age, two shillings *per week* should be allowed from the fund for its maintenance; if more than one of the same family, one shilling and six-pence *per week* for each above that number. As there is probably no less friendship amongst the lower than amongst the higher orders of society, it would generally happen that some friend or relation of the deceased

deceas'd would gladly take charge of the children, provided they could do so without essential loss to themselves. This regulation would effectually prevent that loss; and to compensate in some degree for the want of parental affection, six-pence *per* week more is allowed for the maintenance of an orphan, or a family of orphans, than for a child, or a family of children, who still retain their mother. If, however, any beings should be so uncommonly unfortunate as not to be thus adopted, the officer above-mentioned should be obliged to provide a receptacle for them, which he will always be able to do for the sum or sums above-mentioned. 8. All children above nine years of age, if in health, should, if they have no parents, or their parents are not able to provide for them, be put out after the manner of parish apprentices. 9. All persons neglecting or refusing to pay their contribution, should be committed to the house of correction for the space of ————. 10. If the fund should at any time fall short of the necessary demands upon it, the deficiency should be made up by a parish rate, collected in the same manner as at present; but without any sense of obligation on the part of the multitude, (for there would be no poor,) who should, in all cases, receive their relief in the nature of a demand. 11. If the fund (as most probably would happen) should increase beyond the necessary demands upon it, the surplus should, on no occasion, be diverted to any other purpose than the benefit of the subscribers; but when the price of grain exceeded that which brings it easily within the reach of the multitude (suppose six shillings or six shillings and six-pence the Winchester bushel), every person who had three children or more under nine years of age, should have a right to demand such a sum as, in proportion to the number of his family, would reduce the various necessary articles of life (taking wheat as the standard) to a moderate price; and, indeed, he thinks, in all cases, when the price of grain exceeds that proportion at which the industrious labourer can afford to come to market, sound policy, as well as common humanity, requires that all large families should be entitled to receive such a sum as above specified, although it should be necessary to collect a rate for the purpose.

He need not perhaps add, that every officer intrusted with money should give ample security for his integrity, and the faithful discharge of his duty; that due checks should be established to prevent embezzlement; and that all accounts should be made up and balanced so frequently as to prevent the probability of mistakes. And still more effectually to secure the complete execution of the plan, it would perhaps be necessary to appoint a general inspector of the funds, who, with the assistance of a few subordinate officers, would probably be able to attend the whole kingdom.

And it is supposed by Mr. Donaldson, that if this plan was carried into execution by the legislature, it must in its consequences promote essentially the well-being of the great body of the people, as well as the interests of those concerned in the commerce, manufactures, and agriculture of the country. But though the establishment of friendly or provident societies has, in numerous instances, been found productive of the most salutary effects; and would, if well supported and countenanced in every part of the kingdom by the contributions of the rich proprietors, render compulsory acts of parliament unnecessary; yet as such a mode, however desirable, could probably never be generally adopted, it would certainly be the most effectual method to have an act of parliament for the purpose framed on the above principles: without this or some similar regulation, such societies will probably never, he thinks, become sufficiently general to fully answer the intention. The great

beneficial effects that have resulted from these societies, in those instances in which they have been established in parishes, have been shewn in various statements of them, and should promote their adoption in others, which may easily be done by the principal proprietors in such places taking the lead in forwarding such institutions. In the use of all such regulations, or those of any other similar kinds, they should constantly be brought forward and well adapted to the states, conditions, and circumstances of the situations, places, and times, in which, and at which, they are employed, in order that the best effects may be produced from them.

SOCIETY for propagating the Gospel in foreign Parts was instituted by king William III. in 1701, for securing a maintenance for an orthodox clergy, and making other provisions for the propagation of the gospel in the plantations, colonies, factories, &c.: to that end he incorporated the archbishops, several bishops, and others of the nobility, gentry, and clergy, to the number of ninety, into a body, with privilege to purchase two thousand pounds a-year inheritance, and estates for lives or years, with other goods, to any value.

They are directed by their charter to meet yearly, on the third Friday in February, to choose a president, vice-president, and other officers; and the third Friday in every month, to transact business, depute fit persons to take subscriptions for the said uses, and of all monies so received to give account to the lord chancellor, &c. Of this society there is a standing committee at St. Paul's Chapter-house, who prepare matters for the monthly meeting, which is held at St. Martin's library. They are trustees of Codrington college, in Barbadoes, supported by plantations in that island.

SOCIETY for promoting Christian Knowledge was begun in 1699, by some persons of worth, &c. Its original design was to propagate religion in the plantations, to secure the pious education of the poor at home, and to reclaim those that err in the fundamentals of Christianity.

In the year 1701, they had procured considerable charities, and had transmitted the same to the plantations, in libraries, bibles, catechisms, &c. with a voluntary maintenance for the several ministers to be employed in the plantations. But the society for propagating the gospel in foreign parts being then instituted, they were incorporated, by charter, into the same: and thus discharged, as a particular society, from the farther pursuit of that branch of their original design, which comprehended the appointment and payment of missionaries, as well as the distribution of books; whereupon they wholly turned themselves to the other, and became very considerable, by great accessions from among the clergy and laity.

The members of the society for promoting Christian knowledge meet weekly, at the society's office in Bartlett's Buildings, Holborn, to concert measures for raising charity for the education of poor children, and setting up schools for that purpose; as also for the more regular disposal of pious books and catechisms, for instruction of the ignorant, erroneous, &c. By the assistance of members of other religious societies, they have procured subscriptions for the education of above three thousand children, who are placed out in schools about London, and taught reading, writing, psalmody, &c. They have dispersed great numbers of books among the poor, in the fleet, army, &c. and have procured several to be translated into Welsh, and other foreign languages, and dispersed accordingly. This society for promoting Christian knowledge is supported exclusively by members of the church of England. They have three treasurers,

urers, a secretary, an assistant, a clerk and collector, with two assistants.

SOCIETY, New England, was first incorporated by an ordinance of parliament in 1649, by the name of the "President and Society for the Propagation of the Gospel in New England;" and empowered to receive and dispose of monies in such manner as should best conduce to the preaching and propagation of the gospel among the natives, and for the maintenance of schools for the education of their children; for which purpose a general collection was to be made in all the counties, cities, towns, and parishes of England and Wales. With the sum of money thus collected, the society was enabled to purchase an estate in land of between 500*l.* and 600*l.* a year. But upon the restoration of king Charles II. the charter became void, and colonel Bedingsfield, a papist, who had sold an estate of 322*l.* per annum, which had been settled for the uses of this society, repollesed himself of it, and refused to pay back the money which he had received for it. However, the corporation being revived, in 1661, by an express charter, which ordained, that there be for ever within the kingdom of England, a "Society or Company for the Propagation of the Gospel in New England and the Parts adjacent in America," the estate which had been detained by Bedingsfield was restored by the chancellor's decree. The members of this society are not to exceed forty-five; these and their successors, to be chosen by the society, are constituted one body corporate, with the powers and privileges usual in such cases; and a power is likewise given them to appoint commissioners residing in New England to transact their business in those parts. The honourable Mr. Boyle was appointed by charter the first governor of this company. See a copy of the charter in the Appendix to Dr. Birch's Life of Mr. Boyle.

SOCIETY of the Sons of the Clergy, was incorporated by king Charles II. in 1678, by the name of "The Governors of the Charity for Relief of the poor Widows and Children of Clergymen." This society is under the direction and management of a president and vice-president, three treasurers, and a court of assistants composed of forty members. Several hundreds of widows and children of the clergy have annually received considerable relief from this useful charity. See *Corporation of the Sons of the CLERGY*.

SOCIETY of Stewards and Subscribers for maintaining and educating poor Orphans of Clergymen till of Age to be put Apprentice, an establishment formed in the year 1749, which has attained a considerable degree of prosperity, and which has received into its school more than 700 children of both sexes, most of whom have been apprenticed or otherwise provided for. This society was incorporated by an act of parliament in the 48th year of Geo. III., and it is under the management of a president, vice-president, treasurer, secretary, and committee, elected annually, at a general meeting in February. The committee consists of the principal officers, a secretary, and of 20 other members, any eight of whom shall be deemed a board, who meet every month. See **CLERGY**.

SOCIETY for the Sons of the Clergy of the established Church of Scotland, was instituted at Edinburgh in February 1790, and was constituted a body corporate by his majesty's royal charter in 1792. The views of this society have been limited only to the sons of clergymen, conceiving that its funds will be thus most advantageously employed, and proposing other plans of beneficence which shall also comprehend the daughters of the clergy, as its funds increase.

SOCIETY for promoting religious Knowledge among the Poor commenced in the year 1750, for the purpose of giving

bibles, testaments, and other good books, to those who most needed them, and who were most likely to improve them. This society is supported by an annual subscription of the members, together with the donations and legacies of other contributors; and each subscriber is entitled to a nomination of books in turn, corresponding to the amount of his subscription. The society meets every month.

SOCIETY for promoting Christian Knowledge in the Highlands and Islands of Scotland, was first begun by the allocation of private contributors at Edinburgh, about the year 1701; their design was approved and encouraged by queen Anne, who, in 1708, issued her royal proclamation for this purpose: and, in 1709, she granted a patent, constituting a certain number of the subscribers a society, or body politic, with full powers to receive donations and purchase lands, &c. not exceeding 2000*l.* a year, and with the profits of the same to erect and maintain schools, &c. Accordingly the lords of session, under her majesty's commission, nominated eighty-two subscribers to be the first members of this society, who chose a president, treasurer, secretary, and other officers. They also chose a committee of fifteen, who were to meet every month, or oftener, as occasion required. There is a general meeting of the whole society every three months, when they admit members, make general regulations, give orders to the committee, and settle their accounts. In 1710 the society began to settle schools. In 1738 the king granted a new patent, to cause such children as were found proper to be instructed in husbandry, housewifery, and manufactures; in pursuance of which the society erected several working schools. The society's first charter extends to popish and infidel countries beyond the seas, and four missionaries have been maintained for converting the native Indians in America to the Christian faith. The society has several corresponding members in London, who meet every quarter, to receive subscriptions, donations, &c. These form the Corresponding Board, which was established in the year 1729; and which, after remaining long inactive, began, in 1773, to co-operate more cordially with their brethren in Scotland. Since that period an annual sermon has been preached in commendation of the charity; and the preachers have been selected from various religious denominations with advantage to the charity.

There is also a charitable society in London, corresponding with the incorporated society in Dublin, for promoting the English Protestant charter-schools in Ireland; under the management of a treasurer, a standing committee of fifteen, and secretary, who meet once a month.

SOCIETY for promoting Christianity among the Jews, London, was instituted in August 1808, and it has been conducted under the management of a committee, consisting of eighteen members, besides the treasurer and secretary, five of whom are a quorum; who meet on the first Friday in every month at the Jews' chapel in Spitalfields. The object of this society being to relieve the temporal distresses of the Jews, as well as to promote their spiritual welfare, the committee are empowered, from time to time, to adopt such measures for any such purposes as the majority of the members present may approve. General meetings are held twice in the year, for receiving the reports of the committee; and two collection sermons are preached at each of the half-yearly meetings, for the benefit of the society, one in the established church, and the other among the Dissenters. A sermon is addressed to the Jews every Lord's day evening, and a regular course of lectures is delivered every Wednesday evening. Divine service is performed in the morning and afternoon of every Sunday.

SOCIETY.

SOCIETY for promoting the Discovery of the interior Parts of Africa. See AFRICAN Association and AFRICA.

Of the third kind are divers religious societies, very properly so called: these were first set on foot in London about the year 1678, by a few young men, who agreed to meet weekly, for prayer, psalmody, and spiritual conference. These afterwards increased to forty distinct bodies, who set up public prayers in many churches where they were not before frequent, procured frequent administrations of the sacrament, and maintained lectures on that subject, in one church or another, almost on every Sunday evening.

SOCIETY, *Marine*, was founded, principally, by the late Jonas Hanway, who convened a meeting of merchants and owners of ships, and proposed their forming themselves into a society for giving clothing to landmen and boys for the sea-service. A regular society was formed, and a proper committee and other officers were appointed. By the registers of the society it appeared, that from the 24th of July, 1756, the date of the commencement of this society, to the 1st of February, 1772, it had clothed and fitted out 5451 men, and 6306 boys: and the total number to the 31st of December, 1808, amounted to 20,315 men, and 30,857 boys. By 12 Geo. III. c. 67, A.D. 1772, fifty-two governors were incorporated, from which number are appointed a president, six vice-presidents, a treasurer, and twenty-four (in 1808 the number was sixty) assistants, vested with full powers to carry the designs of the society into execution. Boys serving out their apprenticeships at sea, not being for a less time than four years, are entitled to the liberty of setting up and exercising trade or business in any place in Great Britain or Ireland. No such apprentice is liable to be impressed into the king's service till after the age of eighteen years. Seven governors constitute a general court, which is held four times in every year. The first local residence of this society was in an office over the Royal Exchange; but it has since erected a convenient building in Bishopsgate-street. Among the ornaments and decorations of this building, we may reckon the mausoleum of the late captain Thomas Hanway, presented to the corporation by his brother, Jonas Hanway, esq. on the 1st of September, 1774. An annual subscription of two guineas qualifies a governor for that year; two guineas *per annum*, paid during eight years successively, or a donation of twelve guineas, qualifies a governor for life.

SOCIETY of *St. Patrick, Benevolent*, was established on the 17th of March, 1784, by a considerable number of noblemen and gentlemen, either natives of Ireland or variously connected with it, for the purpose of imparting comfort to persons of that kingdom in distress: one of their objects was the education of children born of Irish parents, residing in or near London. The duke of Kent is patron of this society. The union of this society with the Irish charitable society, instituted in the year 1704, which continued its distributions till the year 1756, when it ceased to meet, was effected by the marquis of Buckingham and a committee, which settled a plan for this purpose. Twenty guineas constitute a governor for life, and three guineas an annual governor. The encouragement which this society has met with has induced it to engage a piece of ground in St. George's Fields, for the purpose of erecting a suitable building by subscription, where the children may by degrees be taken wholly under its own care. The sub-committee meet every month, and the grand committee four times in the year. Its officers are, a patron, president, seven vice-presidents, three auditors, &c. a treasurer, physician, surgeon, and secretary.

SOCIETY, *Philanthropic*, commenced at a small house on

Cambridge-Heath, near Hackney; but as it prospered, buildings have been erected in St. George's Fields, to which a chapel has been lately added. The institution takes its date in the year 1788, and was formed for the prevention of crimes, and the reform of the criminal poor, by the encouragement of industry, and the culture of good morals among those children who were training in vicious courses, public plunder, infamy, and ruin. In December 1789, the number of wards for both sexes under the society's care was sixty. The fund of the society is employed as a manufacturing capital, the instruction for which will serve at any future time to afford the children employment when they are capable of being journeymen. The age of admission is limited to the ages of seven and fourteen, and the children taken under the care of the society are either the offspring of convicted felons, or such as have themselves been engaged in criminal practices. Those of the first class are orphans; and those of the second class are such as in many cases have been guilty of offences at an age which saves them from legal punishment. Objects are admitted by the committee at its weekly meetings; and they are seldom taken younger than eight or nine, or older than twelve. After admission, boys that have been delinquents are sent in the first instance to the "Reform," a house at Bermondsey so called; where the system is framed with a view to the amendment of the moral character by instruction: out of school-hours they are set to pick oakum, that by remaining unemployed they may not acquire habits of idleness. When any of them appear, by the reports of the chaplain, to be sufficiently reformed, they are transferred to the manufactory in St. George's Fields, and placed on the same footing with the rest of the boys in that situation. The sons of convicts, not having been themselves criminal, are sent at once to the manufactory, which contains, besides accommodations for lodging about 100 boys, workshops for carrying on the following trades, *viz.* printing, copper-plate printing, book-binding, shoe-making, tailor's work, ropemaking, and twine-spinning. The profits of the trades are carried to the account of the society, a portion being appropriated, by way of reward, to such of the boys as are industrious, partly paid to them immediately, and partly reserved for their use when they cease to belong to the society. The girls are placed in a building contiguous to the manufactory; but all intercourse between them and the boys is effectually prevented by a wall of considerable height. The girls are brought up for menial servants: they make their own clothing, and shirts for the boys, and wash and mend for the manufactory: besides which, their earnings in plain work are considerable. When of proper age, they are placed out, at low wages, in reputable families, and receive rewards for good behaviour at the end of the first and third years of their service, *viz.* one guinea at each period. A chapel has been erected for the convenience of their attending public worship.

Every general court must consist of seven members at least; and the committee, which consists of twenty-four members, together with the principal officers, visitors, and auditors, meet once a week, and three of them are competent to proceed to business. They appoint sub-committees. A number of boys having served a regular apprenticeship in the society's manufactory, and received certificates of their honesty and industry during the latter part of their service, are now employed in town as journeymen to respectable masters; and many of the girls are in service, and have received the pecuniary rewards assigned them. The present officers are his royal highness the duke of York, president, twelve vice-presidents, a treasurer, four visitors, three auditors,

ditors, a chaplain, reader at the chapel and secretary, two preachers, a physician, surgeon, apothecary, superintendent, and steward.

SOCIETY, *Philological*, comprehends a school for general instruction and clothing of the sons of poor clergymen, naval and military officers, reduced tradesmen, and mechanics. It was instituted in the year 1792, under the patronage of the duke of York, by Mr. Thomas Collingwood of Upper Titchfield-street, Mary-le-bone. This society has adopted a plan of education more liberal than is usually provided for in common schools of charitable institutions. The school is established at Lillón Green, Paddington. The committee, consisting of five members, meet every month, and a general court is held once a year. The officers are his royal highness the duke of York, a president, eleven vice-presidents, three trustees, a committee of twenty, a secretary, several masters, a solicitor, physician, surgeon, apothecary, and collector.

SOCIETY, called the *African Institution*, was established for the important object of attempting the civilization of Africa, and of educating Africans. See *AFRICAN INSTITUTION*.

SOCIETY of Friends, for American Indian Civilization, was instituted by the Friends in the year 1795, and the object of it has been prosecuted with their customary assiduity and perseverance, and with such success, that the northern tribes of American Indians have been considerably influenced to adopt the arts of cultivation, as a prelude to their being capable of receiving the truths and blessings of religion. The whole fraternity of Quakers interest themselves in the promotion of these objects.

SOCIETY, British and Foreign Bible. This society, which has been extremely successful in promoting the circulation of the holy scriptures, was established in the year 1804; and almost as soon as it was embodied, lord Teignmouth became the president, and the bishops of London, Durham, Salisbury, and St. David's, with several noblemen and gentlemen of high respectability, accepted the office of vice-presidents. Thus constituted and patronized, from the popularity of its plan, and the exertions of its conductors, it obtained a rapid establishment in the world, and may be considered as possessing a larger and more efficient operation than was ever acquired by an institution for charitable purposes to be met with on the page of history. Upon its appearance before the public, Wales and Scotland distinguished themselves by individual, congregational, and associated contributions to its funds; and rivalled each other, and their fellow-citizens in England, by the promptitude of their support. Ireland also joined in the work. The continent of Europe felt the impulse which London had excited, and evinced the effects of it in local associations for prosecuting the same common purpose. Asia displayed a similar spirit, and Calcutta became the seat of a corresponding committee, professing, in the name and chiefly by the funds of the society in London, to aid and encourage translations of the scriptures into all the vernacular dialects of the East. In some parts of America there was a similar union of Christians upon kindred principles, and with the same object in view. Several of these associations have been assisted by voluntary donations from the British and Foreign Bible Society. "Thus," says the historian of this institution, "the flame which was kindled in London has been propagated generally over more than three-fourths of the world, and is on its way for a still more extensive and particular diffusion."

The seat and centre of this institution is London: its larger component parts are to be traced in auxiliary societies, formed under its encouragement, and contributory to its

object and operation, in several of the most considerable towns throughout the united kingdom, in all the villages about the metropolis, and in conspicuous stations throughout the other portions of the world, already enumerated. Its auxiliaries within the united kingdom are more than 150, and they comprehend some of the most important and commanding positions. On the continent it has three auxiliaries of great activity, and acting under very respectable patronage, in Stockholm, Berlin, and Basle. These stations, from their local situation, and the conveniencies with which they abound, are peculiarly favourable to the object of supplying the inhabitants of Europe with the scriptures, in their several languages. The Calcutta society, consisting of Christians of different denominations, and patronized, in a measure, by the existing government, will be able in time to furnish bibles to the native Christians, said to amount to a million in number, and to produce correct versions of the scriptures in the various languages of the East, and to open channels for their circulation among millions of people who have never yet heard of the divine mission of Jesus Christ. In America the society is assisted in the prosecution of its object by the Bible Societies of Philadelphia, New York, Connecticut, Massachusetts, New Jersey, &c.; all produced by the example of the London society, aided by its funds, and acting in avowed communication and harmony with it. "In addition to these regular and organized bodies, the society has correspondents of various descriptions in different parts of the world, actively engaged in promoting its designs, by dispersing, at its expence, the sacred oracles of divine truth to men of every nation under heaven."

In the first six years of the existence of this society it had issued from its depository in London more than 325,000 copies of the scriptures, independently of those which had been printed under its auspices, beyond the limits of the united kingdom. In England it has printed the scriptures, at its own expence, in the English, Welsh, Gaelic, French, Spanish, Portuguese, Italian, Dutch, Danish, Mohawk, Equimaux, Modern Greek, Manks, and native Irish languages. On the continent it has largely aided the printing of them in nearly twenty different languages. In Asia it has promoted, by liberal contributions, the translation and publication of them in a great variety of languages and dialects.

The object of this society, which has already expended several hundred thousand pounds, is distinctly and exclusively to promote, in the largest practicable extent, the circulation of the holy scriptures, without note or comment, both at home and abroad. By a fundamental law and regulation of the society, the copies circulated in the language of the united kingdom are those of the authorized version only. The constitution of the society comprehends all denominations of Christians, who profess to regard the holy scriptures as the proper standard of religious truth. The members of the society, be their subscriptions what they may, provided they are not less than one guinea annually, are entitled to purchase bibles and testaments at reduced prices, to five times the amount of their annual subscription. For a farther account of this society, we refer our readers to its annual reports, which are now grown to the size of a moderate octavo volume.

Ten guineas constitute a member for life, and one guinea an annual member, five guineas an annual governor, and fifty pounds a governor for life. Its officers are a president, treasurer, assistant secretary, collector, and bookseller.

An auxiliary *Bible Society* was established for the county of Surrey in 1812. Its officers are a president, twelve vice-presidents, a treasurer, and two secretaries.

SOCIETY.

SOCIETY, Sunday School, was established, in 1796, for promoting free and Sunday schools in Wales, under the patronage of the prince of Wales. Its officers are a president, vice-president, treasurer and vice-treasurer, and secretary.

Society for promoting Sunday schools throughout the British dominions was instituted in 1785. See SCHOOLS.

SOCIETY for the Suppression of Vice, was established in Essex-street, in the Strand, in 1802. Its officers are a president, twelve vice-presidents, a treasurer, a secretary, and collector.

SOCIETY, National, for promoting the education of the poor in the principles of the established church, in England and Wales, was instituted in 1811. The prince of Wales is patron, and the archbishop of Canterbury president: it has a great number of vice-presidents, including all the bishops, a treasurer, and secretary.

SOCIETY, Naval and Military Bible, was instituted in 1780, for the purpose of distributing bibles among the soldiers and sailors of the army and navy. One guinea constitutes a governor, and ten guineas a governor for life.

SOCIETY or Fund for the Support of decayed Musicians and their Families, was established in 1738, and incorporated in 1790.

This institution had always been patronized by many of the first families in the kingdom, as honorary subscribers; and the public in general eagerly attended the annual benefits, which, with the subscriptions of the professional members and gratuitous performance, produced a considerable sum. But the benevolent spirit of the establishment was narrowed, and insufficient to furnish means of comfort to the claimants already on their list, and consequently precluded the augmentation of their number, till after that memorable event, the Commemoration of Handel in 1784, by which 6000*l.* were added to their fund, enabled the governors to enlarge and extend their bounty, by a more considerable allowance to the decayed claimants and their families already on their list, and to be less scrupulous in the admission of new members.

Their majesties and the royal family having been graciously pleased to countenance this establishment, and honour it with their presence, not only at all the commemoration performances, but at every subsequent annual benefit for its support, increased its importance, and excited an ambition in the members to be under the immediate protection of his majesty; which wish was most graciously complied with in 1790, by a permission to incorporate themselves under the title of the "Royal Society of Musicians," till which period the institution went under the title of "The Fund for the Support of decayed Musicians and their Families."

SOCIETY for bettering the Condition of the Poor, was founded in 1796. Its object was to examine the cause of individual distress, to remove difficulties in the way of parochial relief, to facilitate the distribution of charitable benefactors, to inspect workhouses and charitable institutions, in order to suggest improvements, and so aid the important cause of religious instruction to the mature and to the young.

SOCIETY for abolishing the Method of sweeping Chimnies by climbing Boys, was instituted in 1802. Ten guineas constitute a perpetual, and one guinea an annual governor.

SOCIETY for the Discharge and Relief of Persons imprisoned for small Debts, was instituted in February, 1772. The debts, or composition for them, of the persons that are relieved must not exceed 10*l.*; and the aged and infirm are preferred, as well as those that have the largest families, and others who have lost their liberty by unavoidable misfortunes, and not by fraud, vice, or extravagance. No debtor

can be relieved a second time. The annual subscriptions are two guineas, and those for life are twenty guineas. Similar in its object is the "Philanthropic Society" at Mile-End; the annual subscription being only twelve shillings, and five guineas constituting a life-governor.

SOCIETY of Friends of Foreigners in Distress, was instituted A.D. 1806, to relieve the destitute in a strange land, by pecuniary, medical, legal, and religious aid. One guinea constitutes an annual governor, and ten guineas a governor for life.

SOCIETY, Hibernian, was instituted A.D. 1806, for the purpose of providing every poor family in Ireland with a copy of the holy scriptures, especially of the New Testament, to increase the number of their Sunday schools, to circulate religious tracts, and to give encouragement to preachers of approved characters. One guinea constitutes an annual member, and ten guineas a member for life.

SOCIETY, Royal Humane, was established A.D. 1774, by Dr. Cogan and Dr. Hawes, for the recovery of the apparently dead by drowning, or by any other causes of suffocation. One guinea constitutes an annual member, and ten guineas a member for life. See DROWNING.

SOCIETY for teaching the indigent Blind. See BLINDNESS.

SOCIETY for the Relief and Instruction of the Deaf and Dumb. See DEAFNESS.

SOCIETY for the Establishment of a literary Fund was instituted A.D. 1790, for the relief of authors in distress, whose claims, stated in writing to the committee, are duly considered by them, and admitted, if proper, at their discretion, whilst the names of the applicants are not disclosed. The annual subscription is one guinea, and that for life is ten guineas. The society's house is in Gerard-street, Soho.

SOCIETY for the Relief of Widows and Orphans of Medical Men in London and its Vicinity, grants to a widow, provided that her income does not exceed 30*l.*, and if she has children, they have not more than 10*l.* per annum each, an annuity, and a sum towards an apprentice fee when the children are fourteen years of age. Any orphan whose father was a member of the society at his death, who has not more than 15*l.* per annum, also receives an annuity; and relief is granted to medical men themselves, rendered incapable of attending to their business. Twenty guineas constitute a member for life, and one guinea an annual subscriber; and a subscriber of two guineas for fifteen years becomes afterwards a governor.

SOCIETY for Relief and Support of disabled Seamen, their Widows and Children, in the Merchant Seamen's Service, was incorporated by statute 20 Geo. II. to provide relief by pensions for seamen incapable of future service by sickness, wounds, or old age, and for the widows and children of those that have been killed or wounded, provided they be under fifteen years of age, or, above that age, incapable of earning a subsistence by some infirmity. Relief is restricted to those who have contributed 6*d.* per month out of his wages to this fund. Fifty pounds constitute a governor. The affairs of the society are conducted at the merchant seamen's office, Royal Exchange, London.

SOCIETY, Missionary, was instituted in the year 1795, for the purpose of spreading the gospel in foreign parts.

SOCIETY for Missions to Africa and the East, was established by voluntary subscription in the year 1799, for the conversion of the African and Eastern tribes. The missionaries fixed their station at Sierra Leone, also on the Rio Pongas and Bassia, where they have opened schools, and worship on the Lord's day; and as the slave-trade declines, or is abolished, they flatter themselves with success. Many

Maroons

Maroons and others are said to have been converted, children baptized, and the civilization of the heathens, and their conversion to Christianity, which must ever concur, are effected. The annual subscription is one guinea, and a life-subscription twenty guineas.

SOCIETY, *Naval Charitable*, was established in 1791, for the relief of indigent orphans, widows, and children of sea-officers, and also sea-officers reduced by misfortunes to indigence. A *modus* has been settled for the subscription; *viz.* by admirals 3*l.* 3*s.*, vice-admirals 2*l.* 2*s.*, rear-admirals 1*l.* 1*s.*, captains 10*s.* 6*d.*, lieutenants 5*s.*, physicians 10*s.*, surgeons 5*s.*, mellers 5*s.*, purfers 5*s.* The sum given to each applicant is limited to 20*l.* A similar charity was established at the Admiralty in 1792.

SOCIETY for the Conversion of Negroes, was instituted by the zeal of the late bishop Porteus, and was chartered in 1795 for the conversion, instruction, and education of the Negro slaves of the British West India islands: for which purpose clergymen are employed as assistants to the parochial clergy there. The bishop, highly to his honour, indulged the consoling hope, "that the same beneficent spirit which by degrees extinguished Pagan slavery, will also gradually, and without injury to any one, relieve mankind from the prellure of this and every other species of personal and perpetual slavery." The subsequent Abolition of the SLAVE-TRADE (which see) has verified this expectation. The funds arise from the rents of estates vested in the corporation of London, under decree of the court of chancery, upon the will of the honourable Robert Boyle.

SOCIETY, *Religious Tract*, began to circulate its small useful tracts in the year 1799; and of these many have been translated into the Danish, Portuguese, French, and Spanish languages, and have been dispersed amongst the prisoners of war, and other foreigners in this country. Auxiliary societies have been founded in several other countries. A donation of ten guineas constitutes a governor for life, and of half-a-guinea an annual governor.

SOCIETY, *Endeavour*, was instituted in 1794, for promoting the principles and duties of the established church, by forming a library of orthodox divinity, and the distribution of books; the occasional relief of indigence, with medical assistance, including midwifery, and inoculation. It is divided into two departments, *viz.* the eastern and the western.

SOCIETY of Schoolmasters was founded in 1798, in order to establish a fund for the benefit of their widows and orphans, and for relief of schoolmasters and ushers become necessitous through age, infirmity, or misfortune. The fund consists of joint stock, which constitutes a benefit society, and the charitable fund, which is supported by contributions of the members of five guineas entrance money, and one guinea annually: benefactions are received from any other person, 2*l.* for life. The joint stock is shared among widows and children of decayed members in certain proportions, and this is disposable property: the charitable fund is employed in relieving members and their widows, educating their orphans, assisting decayed schoolmasters in general and their widows, and helping others who become necessitous.

SOCIETY called the Scots Corporation. See Scots Hospital.

SOCIETY for rewarding Servants, British, commenced in 1792, with a view of offering a reward for meritorious service, either by a commutation of their probable future advantages for a present pecuniary consideration, or by the immediate possession of half the contingent annuity. Subscribers of one guinea may nominate one male or female

hired domestic servant, not exceeding fifty years of age, to be registered for such future rewards. Subscribers of fifteen guineas have the same nomination. If servants have served any subscriber three years whilst registered, they will be entitled to 5*l.* per annum; if more than three years, 6*l.*, to be increased in proportion of 3*l.* for every three years' faithful service to the same subscriber during the registry. In this manner debentures have been granted to 1151 servants.

SOCIETY of the Stock-Exchange Fund. See STOCK-EXCHANGE.

SOCIETY of the Stranger's Friend was constituted to relieve distress wherever it is found, and especially when out of the reach of other assistance, and to give such religious instruction as may be suitable to the persons visited at their own habitations. For this purpose the visitors divide the town into districts, and personally attend and relieve the objects of their compassion.

SOCIETY, *Unitarian*, was instituted in 1791 for promoting Christian knowledge and the practice of virtue, by distributing books selected and approved by its members. The annual subscription is one guinea, and ten guineas constitute a governor for life, who is entitled to a proportional allowance of books.

SOCIETY, *American Philosophical*, was established at Philadelphia in the year 1769, by the union of two societies which had formerly subsisted in that city, for promoting useful knowledge, under the direction of one patron, one president, three vice-presidents, one treasurer, four secretaries, and three curators, who are annually chosen by ballot. The ordinary meetings of this society are held on the first and third Fridays of every month, from October to May inclusive. The society was incorporated by charter 15th March, 1780, and has published several volumes of its Transactions, containing many ingenious papers on general literature and the sciences, as well as respecting those subjects that are peculiar to America.

A society of a similar kind, under the title of the "Academy of Arts and Sciences, &c." has been also established at Boston. See ACADEMY.

A Royal Society of Sciences was instituted at Upsal about the year 1720: the meetings are monthly, and the Transactions are published quarterly, in 4to.

There is also another society at Gottenburg, called the Royal Society of Sciences and Belles Lettres.

The Society of Natural Historians at Berlin was founded by Dr. Martini; in which place there is also a philosophical society.

The Royal Society of Gottingen was instituted by king George II. in 1751.

In France there have been several institutions of this kind for the improvement of science, recounted under ACADEMY; see also INSTITUTE.

For other institutions of a similar nature, and their literary productions, see ACADEMY, JOURNAL, and TRANSACTIONS.

SOCIETY, *Edinburgh, Philosophical*, a society which succeeded the Medical Society, and formed upon the plan of including all the different branches of natural knowledge and the antiquities of Scotland. Its rise and progress towards its present state are as follow.

In the year 1718, a literary society was established at Edinburgh by the learned Ruddiman and others, which, in 1731, was succeeded by another for the improvement of medical knowledge. In the year 1739, the celebrated MacLaurin conceived the idea of enlarging the plan of this society, by extending it to subjects of philosophy and literature.

ration. The institution was accordingly new-modelled by a printed set of laws and regulations, the number of members was increased, and they were distinguished from that time by the title of "The Society for improving Arts and Sciences," or more generally by the title of "The Philosophical Society of Edinburgh." The meetings of this society, interrupted in 1745, were revived in 1752; and, in 1754, the first volume of their collection was published, under the title of "Essays or Observations, Physical and Literary," which has been succeeded by other volumes. This society, in consequence of the suggestion of the professors of the university, and particularly of the principal, the Rev. Dr. Robertson, and the concurrence of the members of the society, was incorporated by royal charter, on the 29th of March, 1783, under the name of "The Royal Society of Edinburgh," instituted for the advancement of learning and useful knowledge. The first meeting was held on the first Monday of August, 1783; when were chosen a president, two vice-presidents, a secretary, treasurer, and a council of twelve persons, who are chosen by ballot annually on the last Monday of November, and by whom the business of the society is conducted. The society consists of ordinary and honorary members, the latter being restricted to persons residing out of Great Britain and Ireland. The election of new members is made at two stated general meetings, held on the fourth Monday of January, and the fourth Monday of June. A candidate for the place of an ordinary member must signify, by a letter addressed to one of the members, his wish to be received into the society; and he must then be publicly proposed at least a month before the day of election. If the proposal be seconded by two of the members present, his name is to be inserted in the list of candidates, and hung up in the ordinary place of meeting. The election is made by ballot, and is determined in favour of a candidate, if he shall have the votes of two-thirds of those present, in a meeting consisting of at least twenty-one members.

The members are divided into two classes, which meet and deliberate separately: one of these classes is denominated the "Physical class," and comprehends within its department the sciences of mathematics, natural philosophy, chemistry, medicine, natural history, and whatever relates to the improvement of arts and manufactures. The other, denominated the "Literary class," has for its department literature, philology, history, antiquities, and speculative philosophy. Each of the classes has four presidents and two secretaries, who officiate by turns. At the meetings of these classes the written essays and observations of the members of the society, or their correspondents, are read publicly, and become the subjects of conversation. The ordinary members, who usually reside in the city of Edinburgh or its vicinity, are expected to attend regularly the monthly meetings, and are required to defray, by an annual contribution, the current expences of the institution. The members who reside at such a distance from Edinburgh, that they cannot enjoy the advantages arising from a regular attendance on the meetings of the society, are not subjected to any contribution for defraying its expences, but have a right to attend those meetings when they are occasionally in Edinburgh, and to take part in all their proceedings. This society has published several volumes of its Transactions, bearing ample testimony to the learning and ingenious researches and observations of their various authors.

SOCIETY, Royal. See *ROYAL Society.*

There is also an Experimental Society at Dublin, for promoting natural knowledge, which was instituted in 1777; the members meet once every week, and distribute three hono-

rary gold medals annually for the most approved discovery, invention, or essay, on any mathematical or philosophical subject. The society is under the direction of a president, two vice-presidents, and a secretary.

A Literary and Philosophical Society, of considerable reputation, has been lately established at Manchester, under the direction of two presidents, four vice-presidents, and two secretaries. The number of members is limited to fifty; besides whom there are several honorary members, all of whom are elected by ballot; and the officers are chosen annually in April. Several valuable essays have been already read at the meetings of this society, and several volumes have been published.

SOCIETY of Antiquaries. See *ANTIQUARY.*

SOCIETY for the Encouragement of Arts, Manufactures, and Commerce, was instituted in the year 1754, in pursuance of a plan formed in 1753, for the purpose of exciting emulation and industry in the improvement of ingenious and commercial arts, the various branches of agriculture, &c. by honourable and pecuniary rewards. It was set on foot by lord Falkstone, lord Romney, Mr. Shipley, Dr. Hales, and a few other gentlemen; but its importance and utility soon gained a very considerable accession of members and subscribers. This society, according to its present constitution, is under the direction and management of one president, sixteen vice-presidents, the chairmen of the several committees of accounts, correspondence, polite arts, agriculture, manufactures, mechanics, chemistry, colonies, and trade; in each of which department there are two, a principal secretary, an assistant secretary, register, collector, and messenger. The office is in the Adelphi.

Every person, desiring to be a member, must be proposed by some member at one meeting, and ballotted for at a succeeding meeting, and if he be chosen by two-thirds of the members present, he is deemed a perpetual member on payment of twenty guineas, or else a subscribing member on payment of any yearly sum not less than two guineas.

The proceedings of the society are regulated by a body of rules and orders established for this purpose; all questions are determined by holding up of hands or ballot, and no matter can be confirmed without the assent of the majority at two meetings. They invite the public in general to propose subjects for encouragement, and whatever is deemed deserving attention is referred to the consideration of a committee, which makes a report to the whole society, where it is approved, rejected, or altered. Their premiums, which have been very extensively bestowed, are either sums of money, or the society's medals in gold or silver.

Their meetings are every Wednesday evening, from the second Wednesday in November to the end of May, and at other times on the first and third Wednesday in every month.

In the Memoirs of Agriculture, and other economical arts, by Mr. Dossie, Bailey's machines of the Society of Arts, and the Transactions of the Society, of which they have published a great number of volumes, we may see how various, extensive, and liberal the plan, which this society has adopted and pursued.

Similar societies, particularly with a view to the improvement of agriculture, have been established in different parts of the kingdom.

The Society instituted at Bath, in the year 1777, for the encouragement of agriculture, arts, manufactures, and commerce, deserves particular mention. The Transactions published by this society contain many valuable experiments and observations, particularly relating to agriculture, which merit

merit the attention of all agriculturalists and farmers in the kingdom.

SOCIETY or *Board of Agriculture*, a society or board of this kind, which was established at London, under the authority of government, for the purpose of promoting agriculture and the internal improvement of the country. It was instituted in or about the year 1793, and consists, according to the charter of its incorporation, of a president, of such several members, by virtue of their different offices, as are therein mentioned, and of thirty ordinary members, mostly members of parliament: besides which, of so many honorary members as they may think proper, and of such a number of corresponding members, natives or foreigners, as may be necessary for the purposes of the institution, the former of whom have the right of being present at all deliberations of the society, but not the latter. Neither of them, however, have the power of voting upon any question.

The president, and a part of the ordinary members, to the number of five, may and are capable of being changed annually on the twenty-fifth day of March. The four vice-presidents may likewise be annually changed, and new ones named and appointed at the same time, as well as the treasurer, and secretary. But the under secretary, the clerk or clerks, with the surveyors, &c. are not subject to annual change.

It cannot be doubted or disputed, that the plans and objects which this establishment has in view, are extremely important, diversified, and comprehensive, as they relate not only to the improvement of the agriculture itself, but to the whole of the internal economy and management of the country. They will probably, however, be best understood by consulting the small tract, which contains an account of the origin of the establishment and its progress for three years afterwards, published in 1796, by its first president, sir John Sinclair.

The consequence and utility of such an institution as this, when under judicious and able management, must obviously be very great, not only to this nation, and the community at large, but also in its example to others, where no similar establishments have yet taken place.

Under such sort of regulation and management, it is unquestionably capable of promoting improvements in many different ways, and with many different designs and intentions, so as to be of the utmost beneficial consequence to the general interests of the country as a whole. Its means are now likewise much more ample and sufficient for accomplishing such purposes, than they were on its first foundation, as they have been, in some measure, increased since that period.

It may in short, by the combination of ingenuity and talent which it affords, be the means of promoting and extending a better, more full, and wider cultivation of the soil and territory of the country, somewhat in proportion to the increasing population, wealth, luxury, and wants of the community; of collecting and embodying the numerous useful scattered facts and practices on the subject, which have been spread throughout the different districts of the kingdom; and of providing and dispersing a more full and correct body of information on all parts of the subject, so as to render the nature of the land, the objects of cultivation, and the modes of performing it, more clearly understood, and approach nearer to the state of perfection. In these ways, it may also be the cause of exciting and drawing a greater and more careful attention to all matters of the agricultural kind, than has hitherto been the case, in all those who either possess rank, property, or talents, in

the different classes of society, all through the country; which, by operating upon the vast mass of knowledge that has been drawn together, must have the effect of giving rise to an almost boundless variety of interesting improvements in the profession, both as a science, and an useful practical art. Some, indeed, have been so much persuaded of this, that they have indulged the notion and supposition of the institution becoming of the greatest advantage and importance to the country. Its utility and benefits must, however, require some length of time, before they can fully display themselves, as is the case in all similar establishments.

SOCIETIES, *County Agricultural*, the various societies of this nature, which are formed and established in different counties and parts of the country, for the purpose of improving and bettering the state of the agriculture and rural management of them. These kinds of societies are now instituted in almost every part of the kingdom, and must have considerable effect in rendering the local modes of managing lands in such situations more perfect and beneficial, as well as in spreading and diffusing the knowledge of the improvements, which are progressively made in the art of cultivation, in a more full, complete, and extensive manner. Though some, who are by no means deficient in intelligence or information, may have doubted of the utility and advantage of these institutions, there can be no reason, on the whole, for supposing that they have not been beneficial to the interests of the nation. As there is probably nothing which is more conducive to general improvement, than a rational spirit of inquiry, investigation, and experiment, the establishment of these kinds of societies would seem to have had a direct disposition and tendency to excite and bring forth such a spirit, as well as to extend it, which has been of the utmost advantage in guiding and directing the attentions and exertions of practical farmers to those methods and objects of management, which are the most suitable and likely not only to be beneficial to themselves, but to the whole nation and community at large.

It is not improbable, however, but by having more regard in respect to their regulations and the general objects of their consideration, as well as to the various local circumstances which are connected with them, they may be rendered a great deal more useful and efficient than they are at present, by producing a much greater competition among the smaller classes of cultivators, and by contributing to a far more exact knowledge of the nature of soils, the dimensions of farms, and the real profits and benefits to be derived from them.

In short, the utility and expediency of institutions of this sort must always be, in some measure, in proportion to the increase of population, and the general wants of the country, in so far as food is required.

Most of the societies of this description, which have been established in this country, comprehend, besides the various local regulations, which relate particularly to themselves, the whole or a great part of the plan and objects which are comprised in the different county reports on the state of agriculture, which have been published by the Board. See *Surveys of the Board of Agriculture*.

Many of these societies existed long before the Society or Board of Agriculture was established.

These societies, besides being useful in promoting and disseminating all sorts of valuable improvements in the local rural managements and practices of the particular districts to which they belong, such as in fencing, draining, tilling, ploughing, sowing, harrowing, cutting, securing, watering, pasturing, flocking, and feeding different kinds of land or soil;

soil; also in breeding, rearing, improving, and encouraging the various sorts of live-stock, in furthering planting in different modes, in bettering the tools and machinery of the art, in distinguishing and encouraging good labourers and servants, in regulating and suiting leases, in establishing necessary and convenient fairs and markets, and in promoting any other beneficial undertakings of the same kind; may be highly important, and of great utility, in circulating and diffusing more extensively the information and instruction collected and brought into order by the Society or Board of Agriculture.

There are many other ways in which such societies may also contribute in benefiting the agricultural interests of the nation.

SOCIETY, *Horticultural, of London*, was instituted in 1804, under a president, a council, three treasurers, and secretary.

SOCIETY, *Asiatic*, an institution planned by the late illustrious sir William Jones, and actually formed at Calcutta, on the 15th of January, 1784, for the purpose of tracing the history, antiquities, arts, sciences, and literature, of the immense continent of Asia. As it was resolved to follow as nearly as possible the plan of the Royal Society of London, of which the king is patron, the patronage of the Asiatic Society was offered to the governor-general and council, as the executive power in the territories of the company. By their acceptance of this offer, Mr. Hastings, as governor-general, appeared among the patrons of the new society; "but he seemed in his private station as the first liberal promoter of useful knowledge in Bengal, and especially as the great encourager of Persian and Sanscrit literature, to deserve a particular mark of distinction;" he was requested, therefore, to accept the honorary title of president. This was handsomely declined in a letter from Mr. Hastings, in which he requested "to yield his pretensions to the gentleman whose genius planned the institution, and was most capable of conducting it to the attainment of the great and splendid purposes of its formation." On the receipt of this letter, sir William Jones was nominated president of the society; and we cannot give the reader a view of the object of the institution in clearer language than that which he employed in his first discourse from the chair.

"It is your design, I conceive (said the president), to take an ample space for your learned investigations, bounding them only by the geographical limits of Asia; so that, considering Hindoostan as a centre, and turning your eyes in idea to the north, you have on your right many important kingdoms in the Eastern peninsula, the ancient and wonderful empire of China, with all her Tartarian dependencies, and that of Japan, with the cluster of precious islands, in which many singular curiosities have too long been concealed: before you lies that prodigious chain of mountains, which formerly perhaps were a barrier against the violence of the sea, and beyond them the very interesting country of Tibet, and the vast regions of Tartary, from which, as from the Trojan horse of the poets, have issued so many consummate warriors, whose domain has extended at least from the banks of the Ilyssus to the mouths of the Ganges: on your left are the beautiful and celebrated provinces of Iran, or Persia, the unmeasured, and perhaps unmeasurable deserts of Arabia, and the once flourishing kingdom of Yemen, with the pleasant isles that the Arabs have subdued or colonized; and farther westward, the Asiatic dominions of the Turkish sultans, whose moon seems approaching rapidly to its wane. By this great circumference the field of your useful researches will be enclosed; but since Egypt had unquestionably an old connection with this

country, if not with China, since the language and literature of the Abyssinians bear a manifest affinity to those of Asia, since the Arabian arms prevailed along the African coast of the Mediterranean, and even erected a powerful dynasty on the continent of Europe, you may not be displeased occasionally to follow the streams of Asiatic learning a little beyond its natural boundary; and, if it be necessary or convenient that a short name or epithet be given to our society, in order to distinguish it in the world, that of *Asiatic* appears both classical and proper, whether we consider the place or the object of the institution, and preferable to *Oriental*, which is in truth a word merely relative, and though commonly used in Europe, conveys no very distinct idea.

"If now it be asked, What are the intended objects of our inquiries within these spacious limits? we answer, *Man* and *Nature*; whatever is performed by the *one*, or produced by the *other*. Human knowledge has been elegantly analysed according to the three great faculties of the mind, *memory*, *reason*, and *imagination*, which we constantly find employed in arranging and retaining, comparing and distinguishing, combining and diversifying, the ideas which we receive through our senses, or acquire by reflection: hence the three main branches of learning are, *history*, *science*, and *art*; the first comprehends either an account of natural productions, or the genuine records of empires and states; the second embraces the whole circle of pure and mixed mathematics, together with ethics and law, as far as they depend on the reasoning faculty; and the third includes all the beauties of imagery and the charms of invention, displayed in modulated language, or represented by colour, figure, or sound.

"Agreeably to this analysis, you will investigate whatever is rare in the stupendous fabric of nature, will correct the geography of Asia by new observations and discoveries; will trace the annals and even traditions of those nations who from time to time have peopled or desolated it; and will bring to light their various forms of government, with their institutions civil and religious; you will examine their improvements and methods in arithmetic and geometry; in trigonometry, mensuration, mechanics, optics, astronomy, and general physics; their systems of morality, grammar, rhetoric, and dialectic; their skill in chirurgery and medicine; and their advancement, whatever it may be, in anatomy and chemistry. To this you will add researches into their agriculture, manufactures, and trade; and whilst you inquire with pleasure into their music, architecture, painting, and poetry, will not neglect those inferior arts by which the comforts and even elegancies of social life are supplied or improved. You may observe that I have omitted their languages, the diversity and difficulty of which are a sad obstacle to the progress of useful knowledge; but I have ever considered languages as the mere instruments of real learning, and think them improperly confounded with learning itself: the attainment of them is, however, indispensably necessary; and if to the Persian, Armenian, Turkish, and Arabic, could be added not only the Sanscrit, the treasures of which we may now hope to see unlocked, but even the Chinese, Tartarian, Japanese, and the various insular dialects, an immense mine would then be open, in which we might labour with equal delight and advantage."

Of this society eleven volumes of the Transactions have been published, which are replete with information in a high degree curious and important; and we hope that the European world will soon be favoured with another. The much-to-be lamented death of the accomplished president may indeed damp the spirit of investigation among the members;

bers; for to conquer difficulties so great as they must meet with, a portion seems to be necessary of that enthusiasm which accompanied all the pursuits of sir William Jones; but his successors will, we trust, use their utmost endeavours to have the plan completed of which sir William gave the outlines.

SOCIETY for working Mines, an association not long ago formed on the continent of Europe. This institution originated at an accidental meeting of several mineralogists at Skleno, near Schemnitz, in Hungary, collected to examine a new method of amalgamation. The object of the society is physical geography; mineralogy founded on chemistry; the management of ore in the different operations which it undergoes; subterraneous geometry; the history of mining; founderies, and the processes for the extraction of the metals from the ores, either by fusion or amalgamation, in every instance applied to practice. The end of this institution is to collect, in the most extensive sense, every thing that can assist the operations of the miner, and to communicate it to the different members, that they may employ it for the public good, in their respective countries. Each member must consider himself as bound to lend to the society every thing which will contribute to the end of its institution; to point out, with precision, the several facts and observations; to communicate every experiment which occurs, even the unsuccessful ones, if the relation may seem to be advantageous to the public; to communicate to the society their examination of schemes, and their opinions on questions proposed by it; and to pay annually two ducats (about 18s. 6d.) to the direction every Easter. The society, on the other hand, is bound to publish every novelty that shall be communicated to it; to communicate to each member, at the member's expence, the memoirs, designs, models, productions, and every thing connected with the institution; to answer all the necessary demands made, relating in any respect to mining; and to give its opinion on every plan or project communicated through the medium of an honorary member.

The great centre of all intelligence is to be at Zellerfeld, in Hartz, Brunswick: but the society is not fixed to any one spot: for every particular state some practical mineralogist is nominated as director. Among these are the names of baron Born, M. Pallas, M. Charpentier, M. Prebra, and M. Henkel. Their office is to propose the members; to take care that the views of the society are pursued in the different countries where they reside; to answer the requests of the members of their country who are qualified to make them; in case of the death of a director, to choose another; and the majority is to determine where the archives and the strong box is to be placed.

All the eminent mineralogists in Europe are members of this society. It is erected on so liberal and so extensive a plan, that we entertain the highest hopes of its success; and have only to add, that we wish much to see the study of several other sciences pursued in the same manner.

SOCIETY, British, for extending the Fisheries, and improving the Sea-Coasts of this Kingdom, was instituted in 1786. The end and design of this society will best appear from their charter, of which we present an abstract.

The preamble states, "the great want of improvement in fisheries, agriculture, and manufactures, in the Highlands and islands of North Britain; the prevalence of emigration, from the want of employment in those parts; the prospect of a new nursery of seamen, by the establishment of fishing towns and villages in that quarter. The act therefore declares, that the persons therein named, and every other person or persons who shall thereafter become proprietors of the joint stock mentioned therein, shall be a distinct and

separate body politic and corporate, by the name of "The British Society for extending the Fisheries and improving the Sea-Coasts of this Kingdom:"—that the said society may raise a capital joint stock, not exceeding 150,000*l.*, to be applied to purchasing, or otherwise acquiring, lands and tenements in perpetuity, for the building thereon, and on no other land whatever, free towns, villages, and fishing stations:—that the joint stock shall be divided into shares of 40*l.* each:—that no one person shall, in his or her name, possess more than ten shares, or 500*l.*:—that the society shall not borrow any sum or sums of money whatsoever:—that the sums to be advanced for this undertaking, and the profits arising therefrom, shall be divided proportionably to the sum subscribed; and that no person shall be liable for a larger sum than he or she shall have respectively subscribed:—that one or two shares shall entitle to one vote and no more in person or by proxy, at all meetings of proprietors; three or four shares to two votes; five, six, or seven shares, to three votes; eight or nine shares to four votes; and ten shares to five votes, and no more:—that more persons than one inclining to hold in their joint names one or more shares, shall be entitled to vote, by one of such persons, according to the priority of their names, or by proxy:—that bodies corporate shall vote by proxy under their seal:—that all persons holding proxies shall be proprietors, and that no one person shall hold more than five votes by proxy:—that the affairs of the society shall be managed by a governor, deputy-governor, and thirteen other directors, to be elected annually on the 25th of March, from among the proprietors of the society, holding at least one full share, by signed lists of their names, to be transmitted by the proprietors to the secretary of the society:—that five proprietors, not being governor, director, or other officer, shall be in like manner annually elected to audit the accounts of the society:—that there shall be one general meeting of the proprietors annually, on the 25th of March:—that occasional general meetings shall be called, on the request of nine or more proprietors:—that the general meetings of the proprietors shall make all bye-laws and constitutions for the government of the society, and for the good and orderly carrying on of the business of the same:—that no transfer shall be made of the stock of the society for three years from the 10th of August 1786:—that the cash of the society shall be lodged in the bank of England, bank of Scotland, or the royal bank of Scotland:—that no director, proprietor, agent, or officer of the society, shall retain any sum or sums of money in his hands beyond the space of thirty days, on any account whatsoever:—that all payments by the society shall be made by drafts on the said banks, under the hands of the governor or deputy-governor, countersigned by the secretary or his deputy, and two or more directors:—and that the books in which the accounts of the society shall be kept shall be open to all the proprietors."

The institution of this public-spirited society was in a great measure owing to the exertions of the patriotic John Knox; who, in the course of twenty-three years, traversed and explored the Highlands of Scotland no less than sixteen times, and expended several thousand pounds of his own fortune in pursuing his patriotic designs.

SOCIETY, British Wool. See *British Wool Society*.

SOCIETY, Geological, was instituted in 1811, under a president, four vice-presidents, treasurer, two secretaries, and a foreign secretary.

SOCIETY, Mineralogical, was instituted in 1799; but it is now incorporated with the former.

SOCIETY, Entomological, of London, instituted in 1806,

has a president, vice-president, treasurer, and secretary, several fellows, and a printer.

SOCIETY, Linnæan, was founded in 1788, and incorporated in 1802. Its president is Sir James Edward Smith; it has a council, a treasurer, secretary, and librarian. Its house is in Gerard-street, Soho. It has already (1816) published eleven volumes of its Transactions.

SOCIETY, Mathematical, in Crispin-street, Spitalfields, was established in 1717. It is under the conduct of a president, treasurer, and secretary.

SOCIETY for the Improvement of Naval Architecture, was founded in 1791. The object of it is to encourage every useful invention and discovery relating to naval architecture, as far as shall be in their power, both by honorary and pecuniary rewards. They have in view particularly to improve the theories of floating bodies, and of the resistance of fluids; to procure drafts and models of different vessels, together with calculations of their capacity, centre of gravity, tonnage, &c.; to make observations and experiments themselves, and to point out such observations and experiments as appear best calculated to further their designs, and most deserving those premiums which the society can bestow. But though the improvement of naval architecture in all its branches be certainly the principal object of this institution, yet the society do not by any means intend to confine themselves merely to the form and structure of vessels. Every subordinate and collateral pursuit will claim a share of the attention of the society, in proportion to its merits; and whatever may have any tendency to render navigation more safe, salutary, and even pleasant, will not be neglected.

This institution owes its existence to the patriotic disposition and extraordinary attention of Mr. Sewell, a private citizen of London, who (though engaged in a line of business totally opposite to all concerns of this kind) has been led, by mere accident, to take such ocular notice of, and make such observations on, the actual state of naval architecture in this country, as naturally occurred to a man of plain understanding, zealous for the honour and interest of his country, and willing to bestow a portion of that time for the public good, which men of a different description would rather have devoted to their own private advantage. His attention was the more seriously excited, by finding that it was the opinion of some private ship-builders, who, in a debate on the failure of one of our naval engagements, pronounced, that such "would ever be the case while that business (the construction of our ships of war) was not studied as a science, but carried on merely by precedent; that there had not been one improvement in our navy that did not originate with the French, who had naval schools and seminaries for the study of it; and that our ships were not a match for those of that nation, either singly or in a fleet, &c. &c."

In a short time the society were enabled to offer very considerable premiums for particular improvements in the construction of our shipping, &c. &c. and also to encourage our philosophers, mathematicians, and mechanics, to make satisfactory experiments, tending to ascertain the laws of resistance of water to solids of different forms, in all varieties of circumstances. On this head the reward is not less than 100*l.* or a gold medal. Other premiums of 50, 30, and 20 guineas, according to the importance or difficulty of the particular subject or point of investigation, are likewise offered, for different discoveries, inventions, or improvements. The terms of admission into the society are a subscription of two guineas annually, or twenty guineas for life.

SOCIETY of Civil Engineers. This society took its rise from the following circumstances. Before or about the year 1760, a new era in all the arts and sciences commenced in this country. Every thing which contributes to the comfort, the beauty, and the prosperity of a country, moved forward in improvement, so rapidly and so obviously, as to mark that period with particular distinction. It was about this time that manufactures were extended on a new plan, by the enterprise, the capital, and, above all, by the science of the men of deep knowledge and persevering industry engaged in them. It was seen that it would be better for establishments to be placed in new situations, adapted to the obtaining raw materials, and the labour of patient and retired industry, than to endure the vexations that perpetually occur in corporate towns, and the wages of their extravagant workmen. This produced a new demand, not thought of till that period, in this country,—*internal navigation*. To make communications from factory to factory, and from warehouses to harbours, as well as to carry raw materials to and from such establishments, became absolutely necessary. Hence arose those works, not of pompous and useless magnificence, but of real utility, which have been carried on to a degree of extent and magnitude, to which as yet there is no appearance of limitation.

The *ancient harbours* of this island, it may be said, have ever been an example in the history of mankind. The feats were such as nature had formed, and were but little better, notwithstanding some jetties and piers of defence, which had been made and altered, without knowledge or judgment, at municipal expence. This general situation of things gave rise to a new profession and order of men, denominated "civil engineers." In almost all other polished nations of Europe this was a profession encouraged or instituted by the governments of those countries, of itself, and by itself; but in this country, the formation of a body of such men was left to chance; there was no public establishment, except common schools, for rudimental knowledge necessary to all arts, naval, military, mechanical, and others.

Civil engineers, then, are a self-created set of men, whose profession owes its origin, not to power or influence, but to the encouragement of a great and powerful nation:—a nation become so from the persevering industry of its manufacturing workmen, and their superior knowledge in chemistry, mechanics, and natural philosophy. The same period gave rise to an association of a few gentlemen, of whom Mr. Smeaton was one, who proposed that they might form themselves into a society for the advancement of the science of civil engineering, and in March 1771 it was established, and the members met on Friday evenings, at the Queen's Head tavern, Holborn. It did not increase rapidly, for in twenty years the numbers were less than seventy, and of these, there were only about fifteen who were real engineers, employed in public works, or private undertakings of great magnitude. The other members were either amateurs, or ingenious workmen and artificers connected with, and employed in, works of engineering. A register was kept of the names of its members; and a communication of ideas and knowledge, in the particular walks of each member, were, at the same time, the amusement and the business of the meetings. In this manner the society proceeded till 1792, when it ceased to exist, by mutual consent of the principal members. This dissolution was occasioned by the ill-treatment which Mr. Smeaton experienced from one of the members, who was under very particular obligations to him, but whose name is not mentioned in connection with the act of flagrant ingratitude. See **ENGINEERS**.

An attempt was afterwards made to rebuild the society,

and to place it on a better and more respectable foundation; but before the plan could be matured, Mr. Smeaton was no more. In April 1793, the new society was, however, formed under the denomination of "The Society of Civil Engineers." It consisted of three classes: 1. Of ordinary members, to consist of real engineers, actually employed as such in public or in private service. 2. Honorary members, to consist of men of science and gentlemen of rank and fortune, who had applied themselves to subjects of civil engineering; and who might, for knowledge, have been real engineers, had it not been their good fortune to have it in their power to employ others in this profession; and also of those who are employed in other public service, where such and similar kinds of knowledge are necessary. 3. Honorary members, consisting of various artists, whose professions and employments are necessary, or extremely useful, as well as connected with civil engineering. The meetings of this society are, we believe, still held every other Friday during the session of parliament. It may be mentioned, that the society never meet without paying a just and natural tribute of respect to the memory of Mr. Smeaton, of whom we have already given a biographical article, to which may now be added the following anecdotes, communicated to the public by his daughter Mrs. Mary Dixon.

It was a maxim of this excellent man, that "the abilities of the individual are a debt due to the common stock of public happiness or accommodation." This appears to have governed his actions through life: he devoted his time to the cultivation of talents by which he might benefit mankind. The arrangement of his time was governed by a method as invariable as inviolable; for professional studies were never broken in upon by any one; and these, with the exception of stated astronomical observations, wholly engrossed the forenoon. His afternoons were regularly occupied by practical experiments, or some other branch of mechanics: and he had so complete a command over his thoughts, that his mind was not more entirely devoted to his profession in one division of time, than abstracted from it in another. "Himself," says his daughter, "devoted to his family with an affection so lively, a manner at once so cheerful and serene, that it is impossible to say whether the charm of conversation, the simplicity of instruction, or the gentleness with which they were conveyed, most endeared his home. A home, in which from infancy we cannot recollect to have seen a trace of dissatisfaction, or a word of asperity to any. Yet with all this he was absolute! and it is for casuistry in education, or rule, to explain his authority; it was an authority as impossible to dispute as to define."

At one period the princess Askoff, after having in vain used every persuasion to induce Mr. Smeaton to accept a *carte blanche* from the empress of Russia, as a recompence for directing the vast projects which her majesty had in view, said, "Sir, you are a great man, and I honour you! You may have an equal in abilities, perhaps; but in character you stand single. The English minister, sir Robert Walpole, was mistaken, and my sovereign has the misfortune to know, there is one man, at least, who has not his price."

Early in life Mr. Smeaton attracted the notice of the duke and duchess of Queensbury, from a strong resemblance which Smeaton bore to their favourite Gay, the poet. The commencement of this acquaintance was singular, but the continuance of their esteem and partiality lasted through life. Their first meeting was at Ranelagh, where, walking with Mrs. Smeaton, he observed an elderly lady and gentleman fix an evident and marked attention on him. After some turns they stopped him, and the duchess said, "Sir, I do not know you, but so strongly do you resemble my poor

dear Gay, we must be acquainted; you shall go home and sup with us; and if the minds of the two men accord as much as their countenances, you will find two cheerful old folks, who can love you well, and I think you can as well deserve it." The invitation was accepted, and as long as the duke and duchess lived, the friendship was uninterrupted. In the course of this, he effected the abolition of that inconsiderate indiscriminate play among people of superior rank and fortune, which compels every one to join, and at their own risk. Mr. Smeaton detested cards, and his attention never following the game, he played like a child. The game was *pope Joan*, the general run of it was high, and the stake in *pope* had accidentally accumulated to a very ferocious sum. It was Smeaton's turn by deal to double it, when, regardless of his cards, he busily made some minutes on a scrap of paper, and put it on the board. The duchess eagerly asked what it was; and he as coolly replied, "Your grace will recollect the field in which my house stands may be about 5 acres, 3 roods, and 7 perches, which, at 30 years' purchase, will be just my stake; and if your grace will make a duke of me, I presume the winner will not dislike my mortgage." The joke had the proper effect, and they never after played but for the merest trifle. See Smeaton's Reports, vol. i.

SOCIETY of Artists of Great Britain, which consists of directors and fellows, was incorporated by charter in 1765, and empowered to purchase and hold lands, not exceeding 1000*l.* a year. The directors of this society, annually elected, are to consist of twenty-four persons, including the president, vice-president, treasurer, and secretary; and it is required that they be either painters, sculptors, architects, or engravers, by profession.

SOCIETY of Engravers was established in 1802, under the patronage of the prince of Wales, a president, vice-president, treasurer, and honorary secretary, &c.

SOCIETY of Painters in Oil and Water-Colours was established in 1804, under a president, treasurer, secretary, and committee of management.

SOCIETY of Architects was instituted in 1791; and the *Architectural Society* was formed in 1806, under a president, two vice-presidents, a secretary, and treasurer.

SOCIETY for Insurance, &c. See ASSURANCE and INSURANCE.

SOCIETY, Medical. To this class belong several societies, the principal of which in our own country are the following; *viz.* the Medical Society of London, instituted in the year 1752, on the plan recommended by lord Bacon (*De Augm. Scient. lib. iv. cap. 2.*), to revive the Hippocratic method of composing narratives of particular cases, in which the nature of the disease, the manner of treating it, and the consequences, are to be specified; to attempt the cure of those diseases, which, in his opinion, have been too boldly pronounced incurable; and, lastly, to extend their enquiries after the powers of particular medicines in the cure of particular cases. The collections of this society have been already published, under the title of "Medical Observations and Inquiries," in several volumes:—*Society of Physicians in London*, instituted about the year 1764, the members of which, who must be merely licentiates of the College of Physicians, are elected by ballot, and meet once a fortnight on Wednesday evening, for the purpose of conversing on the prevailing diseases, &c. and dine together once in a quarter:—the Medical Society in Crane-court, instituted in 1773, under the direction of a council, consisting of a president, treasurer, librarian, three physicians, three surgeons, three apothecaries, and three secretaries: the members meet once a fortnight, on Tuesday evening, and their council is annually elected in January, when an oration is delivered by

one of the members on some medical subject :—Society for the Improvement of Medical Knowledge in London, established in 1782, for the purpose of collecting useful essays and observations for publication: the meetings of this society are held once a fortnight, on Tuesday evening, and the members dine together once a quarter; on which occasion candidates for admission are balloted for: the society is under the direction of a president, treasurer, two secretaries, and a committee for revising and selecting papers for publication, who are elected annually by ballot:—the Medical Society of Edinburgh, to which the public are indebted for six volumes of curious and useful essays, collected principally by the late Dr. Monro, from June 1731 to June 1736; but this society was afterwards united to another, called the Philosophical Society:—the Medical Society of Edinburgh, incorporated by royal charter in 1778, under this title: this institution appears to have been coeval with the establishment of a regular school of physic in the university, though none of its records of an earlier date than 1737 are now preserved: the ordinary members of this society are elected by ballot, and three dissentients exclude a candidate; an ordinary member may also be elected an honorary member, who enjoys the privileges of the others, and receives a diploma, but is freed the obligation of attendance, delivering papers in rotation, &c. to which the ordinary members are subject; but in this case the votes must be unanimous; the meetings of this society are held every Saturday evening, in their own hall, during the winter season, when papers on medical subjects are delivered by the several members in rotation; and four of these are annually elected to fill the chair in rotation, with the title of annual presidents.

The Royal Medical Society of Paris was instituted in 1776. The members are divided into associates ordinary, limited to thirty, honorary to twelve, extraordinary to sixty, and foreign to sixty, and correspondents. This society has published several volumes of Memoirs in 4to.

The Medical and Chirurgical Society of London, in Verulam Buildings, Gray's-Inn, was established in 1805. Its council consists of a president, and 15 vice-presidents: it has a treasurer, two secretaries, and a foreign secretary.

SOCIETY, *Philosophical*, designated by the style and title of the "Royal Institution," was established in the year 1799, and in its charter of incorporation, states that it is formed with a view "of diffusing the knowledge and facilitating the general introduction of useful mechanical improvements; and for teaching, by courses of philosophical lectures and experiments, the application of science to the common purposes of life." In the execution of this plan, a spacious and commodious house was purchased in Albemarle-street, where convenient rooms have been prepared for the reception and public exhibition of all such new mechanical inventions and improvements as shall be thought worthy of public notice, and proper to be publicly exhibited; and, more especially, of all such contrivances as tend to increase the conveniencies and comforts of life, to promote domestic economy, to improve taste, or to advance useful industry. Working models are provided and exhibited, of such new mechanical inventions as are applicable to the common purposes of life. A lecture room is also fitted up for philosophical lectures and experiments; a complete laboratory and philosophical apparatus, with the necessary instruments for making philosophical and chemical experiments, are provided; and men of the first eminence, in various branches of science, are engaged for carrying into full effect this important and useful part of the plan. A library well furnished with books in various departments of literature and science is also provided. Access to the library and lectures may be had on certain conditions.

Societies of a similar kind, but in a less perfect and splendid state, although in some respects no less useful, are the London, Surrey, and Russel institutions. See the article LONDON.

SOCIETY of London, *Philosophical*, which owed its rise and present flourishing state, in a very great degree, to the active and persevering exertions of the ingenious T. J. Pettigrew, esq. was founded in October 1810. The objects of this society, stated in its address to the public, are to foster genius, to eradicate unphilosophical prejudice, to increase the knowledge of nature and of man, to destroy, as much as possible, the false definition of words, which has been so justly reprobated by Bacon and Locke, as the origin of sophistry and misconception; but, above all, to remove the barrier erected by pedantry against universal knowledge, and to subdue an *esprit de corps*, which has been introduced into philosophy, tending to confine it within the narrow limits of sects, and preventing its natural diffusion among mankind. The means adopted to attain these objects are, first, to promote a literary taste by the erection of a library common to all the members; humbly to diffuse more widely a familiarity with science by lectures in every department of philosophy; and thereby to cultivate a correct mode of reasoning, by subjecting those lectures to a rigorous subsequent investigation, and by introducing discussions which correspond with the general objects of the society. In this society there are three classes of members, *viz.* ordinary, honorary, and corresponding. Every ordinary member pays at his entrance the sum of two guineas, which shall be repeated annually; he shall also subscribe to the regulations of the society; and upon withdrawing himself forfeit all title to the property of the society. No person shall be deemed eligible as an honorary member, unless he be author of some scientific work of celebrity, or professor of some branch of philosophy; and the same qualifications are required in a corresponding member, except in the case of such ordinary members, removed from town, as the council may think proper to admit. A person proposed for admission must be recommended by three members, whose names, together with that of the person nominated, shall be hung up in the society's lecture-room fifteen days previous to his being balloted for by the council. In ballots, three black balls shall be considered as a rejection. Each member shall be allowed to introduce three persons at the ordinary meetings of the society; and he shall also be permitted to borrow books of the society. The society shall meet on every Thursday, at eight o'clock in the evening, and a lecture shall be delivered at every alternate Thursday, and the intermediate meetings shall be occupied in discussing the preceding lecture, or in the discussion of some philosophical question, which may have been submitted to and approved of by the council. The society shall meet every alternate Tuesday evening at the same time, to converse on philosophical subjects, or for the reading of papers previously presented to and approved of by the council. In the discussions and proceedings of the society, theological and political subjects shall not be admitted.

The business of the society is conducted by a president, eight vice-presidents, a treasurer and secretary, two curators, a registrar and assistant, and a council composed of eighteen members; all of these are elected annually. The patrons of the society are the dukes of Kent and Sussex. The number of members already amounts to 200, and the library consists of about 500 volumes. In both these respects the society is receiving numerous accessions.

SOCIETY Islands, in *Geography*, a cluster of six islands in the Pacific ocean, so called by captain Cook in 1769, because they lie contiguous to each other, so that he did not think

think it proper to distinguish them by any other names than those by which they were known to the natives; viz. Ulitea, Otaha, Bolabola, Huaheine, Tubai, and Maurua. See each respectively. They are situated between S. lat. $16^{\circ} 10'$ and $16^{\circ} 55'$, and between W. long. $150^{\circ} 57'$ and 152° . Ulitea and Otaha lie within about two miles of each other, and are both inclosed within one reef of coral rocks, so that there is no passage for shipping between them. This reef forms several excellent harbours; and though the entrances into them are narrow, yet a ship within them is exempt from all injury. The inhabitants, climate, and produce, are similar, in many respects, to those of Otaheite, from which island they are not above 50 leagues distant towards the N.W. Captain Cook says, "while we were employed about these islands, we expended very little of the ship's provisions, and were very plentifully supplied with hogs, fowls, plantains, and yams, which we hoped would be of great use to us in our course to the southward; but the hogs would not eat European grain of any kind, pulse, or bread-dust, so that we could not preserve them alive; and the fowls were very soon seized with a disease that affected the head, so that they continued to hold it down between their legs till they died: much dependence, therefore, must not be placed in live-stock taken on board at these places, at least not till a discovery is made of some food which the hogs will eat, and some remedy for the disease of the poultry."

SOCIETY-Land, a township of America, in the state of New Hampshire and county of Hillsborough; containing 199 inhabitants.

SOCII, ALLIES, among the Romans. See **ALLIANCE** and **SOCIAL War**.

SOCINIANS, in *Ecclesiastical History*, a sect of Antitrinitarians, who are said to have derived this denomination from the illustrious family of the Sozzini, which flourished a long time at Sienna, in Tuscany, and produced several great and eminent men; and, among others, Lælius and Faustus Socinus, who are commonly supposed to have been the founders of this sect. Lælius was the son of Marianus, a famous lawyer, and distinguished by his genius and learning, as well as by the lustre of an unblemished and virtuous conduct. Having conceived a disgust against popery, and disapproving many doctrines of the church, he left his country in 1547; and having passed four years in visiting France, England, Holland, Germany, and Poland, he at last fixed his residence at Zurich, in Switzerland, where he died in 1562, in the thirty-seventh year of his age. Although he adopted the Helvetic confession of faith, and professed himself a member of the church of Switzerland, he entertained doubts with respect to certain doctrines of religion, which he communicated to some learned men, whose judgment he respected, and in whose friendship he could confide. However, his sentiments were propagated in a more public manner, after his death; as Faustus, his nephew and his heir, is supposed to have drawn from the papers he left behind him, that religious system, upon which the sect of the Socinians was founded. This Faustus Socinus was born at Sienna in 1539; and having continued many years in his own country, twelve of which he spent in the court of the grand duke of Tuscany, he determined, in the year 1574, and the thirty-fifth of his age, to withdraw from Italy into Germany. During this period he had laboured under many disadvantages in the pursuit of knowledge, and his studies had been chiefly confined to the rudiments of logic and jurisprudence; but at Basil, where he first resided after his voluntary exile, he devoted himself for three years to the study of theology, under the direction and assistance of the writings of his uncle Lælius; and in 1577 he began to pro-

pagate his religious opinions without reserve or disguise. In 1578 he was invited by Blandrata, a person of eminence in Transylvania, to compose the commotions which were occasioned by a party under the lead of Francis David, in the Antitrinitarian churches of that country. But failing of success, he removed to Poland in 1579, zealously wishing to join himself to the Unitarian churches; but here he suffered many vexations, and much opposition, from a considerable number of persons, who looked upon some of his tenets as highly erroneous. At length, however, he vanquished the animosity of his enemies by his gentleness and firmness, by his address and eloquence, and the favour and protection of the nobility, with which he was honoured, and lived to form the Unitarians into one community, under his own superintendency and direction. Having retired to a village about nine miles from Cracow, he there closed his life, in the year 1604; and the following epitaph was inscribed on his tomb:

"Tota licet Babylon destruxit testâ Lutherus,
Muros Calvinus, sed fundamenta Socinus:"

i. e. Luther destroyed the houses of Babylon, Calvin the walls, but Socinus subverted the foundations. The sentiments of Socinus, with regard to the principal theological subjects controverted among Christians, will appear in the following abstract of them from his own writings; some of which were published during his own life, and some after his death; and the collection of them, in two volumes, folio, forms part of the "Bibliotheca Fratrum Polonorum." With regard to the nature and character of Christ, Socinus maintained, that he was a man, conceived and formed in the womb of the Virgin, without the intervention of a man, by the power of the divine spirit; on this account he was, in a peculiar sense, God's own and only begotten son, as no other person ever was the son of God in the same way, by the immediate origin of his being. Moreover, he was constituted the son of God by his resurrection from the dead, and was then begotten by God, when God raised him from the dead. As to those passages which have been supposed to assert Christ's existence in the heavenly world, previous to his birth and appearance among men, he explains them, by alleging that Christ himself, after he was born, and before he entered on the office assigned him by his Father, was, in consequence of the divine counsel and agency, in heaven, and remained there for some time; that he might hear from God, and being with him, as the Scripture says, might see those things which he was to announce to the world, in the name of God himself; though he explains John, iii. 13, as figurative language. Accordingly, in explaining the first words of St. John's gospel, *In the beginning was the word*, &c. he observes, that the terms, *in the beginning*, do not relate to eternity, but to the order of those things which John was about to write concerning Jesus Christ; imitating Moses, who, in writing his history, opens his introduction with this word *beginning*, in reference to the transactions which he was about to record. And Jesus is called the Word, he supposes, not on account of his nature or substance, but because of the office he discharged when he revealed to us the word of the gospel from the Father. *The word was with God*, *i. e.* Jesus, as the word of God, before he was pointed out by the preaching of the Baptist, was known to God alone. And *the word was God*: the term God, says this commentator, does not denote substance, but authority, power, and beneficence, which were derived from the Father, and which entitled Christ, according to the opinion of this writer, to adoration and worship. His ideas of the efficacy of our Lord's death and mediation are utterly repugnant

repugnant to those that have been generally entertained by persons called Calvinists. Nothing, he says, can be more incompatible with each other, than a free pardon and satisfaction. He adds, no man of judgment and piety ought to entertain the idea of a satisfaction for sin; since it plainly does very much derogate from the power and authority, or goodness and mercy of God; and though a propitiation be not the same thing as a satisfaction, and though God never refrained from the punishment of sin, on account of any real satisfaction given him, yet it is certain, that in remitting the punishment of our sins by Jesus Christ no propitiation intervened; but God hath, from his free will, exhibited himself so propitious to us in Christ, as not to exact the punishment of our sins, though he might justly have done it. However, he allows not only that the death of Christ, and the pouring out of his blood for us, was an offering and sacrifice to God, but that this sacrifice may be said to have been offered up for our sins in order to their being forgiven; yet he apprehended, that this sacrifice, as far as it was expiatory, was offered by Christ, not on the cross, but in heaven itself, after his resurrection. To which purpose he observes, that Christ did not obtain eternal redemption for us before he entered into the holy place, and there assumed the priesthood; and without a priesthood no expiatory offering could be made.

Socinus does also expressly deny the distinct personality of the Holy Ghost, understanding by the Holy Spirit a divine energy or influence.

With respect to the nature and state of man, Socinus thought, that the progenitor of our race was mortal, *i. e.* liable to death, by reason of his frame, and incapable of exemption, without an exertion of the divine favour and influence, which was not granted to him at creation; and, therefore, when the apostle asserts, that by sin death entered into the world, he meant not natural mortality, but the necessity of dying, or eternal death. To this purpose he explains himself: Adam, if he had not sinned, might have been preserved from death by the kindness of God, though naturally mortal; or, if he had died, have been restored to life, and made immortal. By his sin he did, as it were, refuse to give himself and his posterity this blessing; and, therefore, unless the favour of God be renewed to us, we must all die, and remain in the state of the dead. As to the nature of the human soul, it seems to have been the opinion of Socinus, that, after this life, it doth not subsist of itself, without the body, as to be capable of any reward or punishment, or any sensations at all. To the question, whether the first man had any original righteousness before he sinned? Socinus replies, that if by original righteousness be meant such a condition that he could not sin, this certainly was not the state of Adam, as it is clear he did sin. But if original righteousness consisted in this, that his reason had the absolute rule over his appetites and senses, and invariably directed them, then the opinion of those who ascribe it to Adam is supported by no argument: hence it should seem from Adam's fall, that there was no perfect harmony between them; and that his appetites and senses had the dominion over his reason. If it be asked, says Socinus, whether there is original sin? he answers, this is the same as the inquiry, whether men, when they are born, because they derive their origin from Adam, have, on account of his fall, contracted any guilt or punishment, or are obnoxious to either? Therefore, since the consent of the will must constitute guilt, and there can be no punishment without antecedent guilt, it seems not at all possible that either of these should pertain to a man when he is born, as he neither has, nor could have before, any use of his own will. If by ori-

ginal sin be understood certain innate desires, or evil concupiscence in man, and a proneness to sin, this opinion Socinus denies, and labours to refute; concluding upon the whole, that there is no such thing as original sin, *i. e.* a taint or pravity in consequence of the sin of the first man, necessarily produced, or by any means inflicted on the human race; and that no other evil necessarily flows to all his posterity from that first transgression, than by some means or other the necessity of dying; not indeed through the influence of that transgression, but because man, being naturally mortal, was on that account left by God to his own natural mortality, and what was natural became necessary as a punishment on the offender; consequently, they who were born of him must be born in the same circumstances, for he was deprived of nothing he naturally had or could have. From reasoning on this subject, Socinus concludes, that there is a freedom of will in man, and that the powers of man are not so few and feeble, but that he may, with the assistance of God, obey the divine law by the right use and application of his powers. Divine assistance he considers as external and internal; and the latter, he says, is twofold: the one, when God by some means impelleth on the heart what he hath promised to them that obey him; and the other, when he instructs and illuminates the mind rightly to discern his will, in those instances which cannot be expressly contained in his written word: however, this internal assistance belongs only to those who have made good use of the external. The doctrine of predestination Socinus absolutely denies, and he endeavours to account for the presence of the Deity, without admitting that notion of his decrees, which some divines have adopted. On the head of justification, Socinus observes, that God out of his mere mercy justifies us, *i. e.* pronounces us righteous, and grants us forgiveness of sins, and eternal life; but he requireth from us, before this be done, that we believe in Christ, *i. e.* confide in and obey him; and our good works, or the obedience we render to Christ, though not the efficient or meritorious cause, are the *sine qua non*, or indispensable pre-requisite of our justification before God, and eternal salvation. But if any should deviate from this obedience, by falling into sin, and continuing therein, they cease to be justified; nevertheless, by repentance and amendment of life, they may be justified again: but this second repentance, he says, is not in our power, God granting an ability for it to whom he pleaseth.

Socinus denied the perpetuity of baptism, as an ordinance in the church, alleging that it was not prescribed for those who in any other way have publicly given their names to Christ, or from their earliest years have been educated in the Christian discipline; or if it is to be retained in these days, he apprehends it should be retained principally on account of those who have been converted from other religions to the Christian. He farther thought, that, in order to the right administration of baptism, it is previously necessary that the baptized person should be a believer, and he, therefore, reckoned the practice of infant baptism unscriptural and erroneous.

After this compendious abstract of the chief theological sentiments of Socinus, it is proper to observe, that, according to the usual manner of speaking, all are denominated Socinians, whose opinions bear a certain affinity to the system of Socinus: but, in a strict and proper sense, they only are deemed the members of this sect, who embrace wholly, or with few exceptions, the form of theological doctrine, which Socinus either drew up himself, or received from his uncle, and delivered to the Unitarian brethren, or Socinians, in Poland and Transylvania. Their sentiments

are explained at large in their Catechism, printed several times under the title of "Catechesis Ecclesiarum Polonicarum, unum Deum Patrem, illiusque Filium unigenitum, una cum Sancto Spiritu, ex sacra Scriptura consentientium." See *Catechism of Racow*.

The Socinians, like other sects distinguished by one general denomination, are divided into several parties. Some differ from Socinus with regard to the worship of Christ; some deny the eternity of the future punishment of the wicked; and some apprehend it contradictory to maintain God's foreknowledge of future contingencies, &c. See BUDNÆANS, FARNOVIANS, and SEMIJUDAIZERS.

The chief school of the Socinians was at Racow, where they obtained the grant of a settlement, and there all their first books were published. But in the year 1638, in consequence of the intemperate zeal of some students of the Unitarian academy in this city against Popery, a law was enacted at Warsaw, by which it was decreed, that the academy of Racow should be destroyed, its professors banished, the printing-house of the Socinians destroyed, and their churches shut up. This law was immediately executed; and similar edicts were enacted in other parts of Poland. In 1658 another severe act was published by a diet held at Warsaw, requiring all the Socinians to leave the kingdom for ever, and denouncing capital punishment against all who should profess their opinions, or harbour their persons. This terrible edict was renewed in 1661; and in consequence of these measures, the Socinians sought an asylum among their brethren in Transylvania: a considerable number was dispersed through the adjacent provinces of Silesia, Brandenburg, and Prussia, where their posterity still subsist. Others repaired to Holland and England. In Transylvania they still continue numerous; and are much at their ease. In Holland their number is not considerable; and all who profess themselves such are by law excluded from the general toleration which prevails in that kingdom. They are called Collegians.

As to the present state of the Socinians in Poland, a late writer observes, that since their suppression they have had churches, which have assembled in private houses, woods, or fields, as opportunity permitted; and these assemblies have been conducted under the inspection of regular ministers, educated at Leyden and Amsterdam. Since the edict of 1661, they have been included by the Romish party under the general name of Dissidents: however, in those parts of Poland, which by the late partition fell to the lot of Prussia, Russia, or the emperor, they have now their liberty in common with their other dissenting brethren, and their public places of worship. The only society of Socinians in England was that formed by Mr. John Biddle, under the patronage of Mr. Thomas Firmin, and his adherents were called Bidellians; but this name was lost in the more common appellation of Socinians, or, what they preferred, Unitarians. They differed from Socinus, and the foreign Unitarians, in maintaining the personality of the Holy Spirit. This society does not appear to have subsisted after the death of Biddle; nor have the Socinians, though their sentiments have been adopted by several, made any figure as a community in England. The most distinguished Socinian writers, in Poland, were Crellius, Smalcius, Volkelius, Slichtingius, Wolzogenius, Przipcovius, and Stanislaus Lubianicus; to this number some have added Grotius; and in later times we might enumerate Le Clerc, Biddle, Lardner, Lowman, Fleming, Lindsey, Priestley, &c. See on this subject Socini Oper. tom. i. and ii. passim. Mosheim's Eccl. Hist. vol. iv. p. 167, &c. 8vo. Toulmin's Life of Socinus, passim. See UNITARIANS.

SOCK. See SOCCUS.

SOCK and *Scythe-Land*. See HUSBAND-LAND.

SOCK, in *Agriculture*, provincially the share of a plough, or that part that opens the land; but properly the iron part, or fock, which is put upon it. They are of different kinds, as sharp-pointed and feathered on the edge, &c.

The sharp-pointed fock is the most proper and best adapted for all the rough stony sorts of land, being the least in danger of being thrown out of work in them. They are, therefore, the most commonly employed. The feathered fock is the most useful in all such soils as are in a great measure free from stones, though they may be rough on the top. They are, however, occasionally made use of in other circumstances and cases. The feathers of them vary considerably in their nature and forms; some being small and flat, others large and upright, so as to suit different purposes and intentions.

There is also a mixed kind of fock, which has not only a pointed part, but a feathered one likewise. This is found very useful in ploughing, in many cases, where the lands are of the less stony kinds.

All the different kinds of focks should be made in such a manner as to fit the sheath, or fore-part of the head of the plough in the most exact manner, as much in the business of ploughing depends upon this being nicely adjusted. See PLOUGH.

SOCK, *Paring*, that sort of fock which is made use of on any common plough, for the purpose of paring off the surface of sward land. A fock of this kind may be seen at *fig. 9. Plate Paring Ploughs*, which has an upright cutting feather, with an outside cutting wing, and a middle hollow part to be put upon the sheath or head of any common plough. It is very convenient and useful on many occasions, as it is capable of being employed upon any plough which the farmer may chauce to have by him.

SOCKE, the drainage of a farm-yard, or any other yard where dung is laid. See FARM-YARD.

SOCKE-Pit, the receiver or receptacle of the farm-yard drainage or liquors.

SOCKET. Ball and socket. See BALL.

SOCKETS, in a *Ship*, are the holes which the pintles of the murthering pieces go into.

SOCKIA, in *Geography*, a town of Arabia, in the province of Hedsjas; 75 miles S. of Medina.

SOCKNA, a town of Africa, in Fezzan; 150 miles N.N.W. of Mourzouk.

SOCLE, or ZOCLE, in *Architecture*, a flat, square member under the bases of pedestals, of statues, vases, &c. which it serves as a foot, or stand.

The word is French, formed from the Italian *zoccolo*, or the Latin *foccus*, the shoe of the ancient comic actors. Vitruvius calls it *quadra*; we frequently denominate it *plinth*.

SOCLE, *Continued*, is a kind of continued stand, or pedestal, without either base or cornice, ranging round the whole building; called, by Vitruvius, *stereobata*; and, by the French, *soubassement*.

SOCLO, in *Geography*, a river on the coast of the island of Mindoro, which runs into the sea, N. lat. 22° 56'. E. long. 121° 15'.

SOCKMEN, or SOKEMEN, *Socmanni*, such tenants as held their lands and tenements in *focage*; but the tenants in ancient demesne seem most properly to be called *socmans*. See SOC and VILLENAGE.

SOCNA, in our *Old Writers*, a privilege, liberty, or franchise. The word is Saxon.

SOCO, in *Ornithology*, the name of a Brazilian bird of the heron-kind, the *ardea Brasiliensis* of Linnæus, remarkable,

able, beyond all the rest of that genus, for the length of its neck. It is very common in the Brasils; it is smaller than the common heron; its beak is strong, straight, and sharp; its tail short; its head and neck brown, and variegated with black; and its body is of the same colours in different variegations, but its wings have a mixture of whiteness. See HERON.

SOCOA, in *Geography*, a sea-port of France, in the department of the Lower Pyrenées; 8 miles S.S.W. of Bayonne. N. lat. $43^{\circ} 14'$. W. long. $1^{\circ} 36'$.

SOCOCA, a town of Peru, in the diocese of La Paz; 80 miles E.S.E. of Lipas.

SOCOH, Soco, *Soco*, or *Shoco*, in *Ancient Geography*, a city of Judah (Joh. xv. 35; 1 Sam. xvii. 1.), repaired by Heber (1 Chron. iv. 18.), and the place in which his family resided; and afterwards fortified by Rehoboam. (2 Chron. xi. 7.) According to Eusebius, there were two cities named *Socob*, the higher and the lower; 9 miles from Eleutheropolis towards Jerusalem.

SOCOME, in our *Law-Books*, &c. a custom of grinding corn at the lord's mill.

There is a *bond-focome*, where the tenants are bound to it; and *love-focome*, where they do it freely, out of affection to the lord. See MOLTA.

SOCONUSCO, in *Geography*, a province of Mexico, in the audience of Guatemala, bounded on the north by the province of Chiapa, on the east by Vera Paz and Guatemala, on the south by the Pacific ocean, and on the west by the Pacific ocean and Guaxaca. The climate is very hot, the rainy season from April to September, and storms are very frequent; so that the country is far from being either healthy or pleasant; nor does the soil produce much corn, but it affords great quantities of indigo and cocoa-nuts, which are exported by sea to all the other parts of New Spain. The few Spaniards of this country are very opulent.

SOCONUSCO, or *Gueuelan*, a town of Mexico, capital of a province of the same name, situated on a river near the North Pacific ocean; 460 miles S.E. of Mexico. N. lat. $15^{\circ} 28'$. W. long. $94^{\circ} 36'$.

SOCORRO, an island in the North Pacific ocean, about 20 miles in circumference, uninhabited, and barren; about 200 miles W. from the coast of Mexico. N. lat. $18^{\circ} 30'$. W. long. $120^{\circ} 40'$.

SOCOS, a small island in the Atlantic, near the coast of Africa. S. lat. $19^{\circ} 45'$.

SOCOTAI, a town of Upper Siam; 30 miles S.W. of Porfelouc. N. lat. $17^{\circ} 30'$. E. long. 117° .

SOCOTAN, a town of Persia, in the province of Arokhage; 120 miles E. of Arokhage.

SOCOTORA, or SOCOTRA, an island in the Arabian sea, about 25 leagues from Cape Guardafu, in length about 24 leagues, and in breadth 16. Its shore is bold, and affords safe anchorage and good ports: two of its harbours and bays, *viz.* those of Benin and Cora, are particularly distinguished, on account of the security they give to shipping against every wind that blows. Of this island, though much frequented by different trading nations, very various and contradictory accounts have been given by different authors. Some say that it has only one town, called "Talmart," or "Tamary;" whilst others say, that this is the chief of three towns; and others again state, that it has neither town, village, nor house, and that the inhabitants shelter themselves from the heat of the sun in subterraneous dens and caves. It is agreed, however, that the island is populous and fertile, under the government of a prince, or sultan, who was tributary to the sheriffs of Arabia. The inhabitants are mostly Mahometans, who denominate themselves Arabs, and who resemble them in their manners and

language. The whole island abounds in cattle and fruit, with which, besides some other commodities, they trade to Goa, where they are more favourably received than the native Arabs, who are not allowed to enter that town without passports. The produce of the island consists chiefly in aloes, for which it is proverbially famous, frankincense, ambergris, dragon's blood, rice, dates, and coral, which pass from Goa to many parts of the Indies, and to all the kingdoms of Europe. The East India ships formerly stopped here, when disappointed of their passage by the monsoons; but of late the periods of these winds have been so well ascertained, that this port is entirely neglected. N. lat. $12^{\circ} 15'$. E. long. 54° .

SOCRATES, in *Biography*, an ancient moral philosopher, eminently distinguished by his principles and conduct, and proverbially recognized as one of the wisest and best men, whose name and character history has recorded. He was born at Alopecce, a village near Athens, in the fourth year of the 77th Olympiad, B.C. 469. His parentage was obscure; his father, Sophroniscus, being a statuary, and his mother, Phænareta, a midwife; and at an early age he was employed in his father's business, and is said to have executed statues of the habited Graces, which were allowed a place in the citadel of Athens. His patrimony, upon the death of his father, was only the small sum of 80 minæ, or about 300*l.*; and this sum he lost by the dishonesty of a relation, with whom his father had entrusted it. Thus reduced to the necessity of supporting himself by manual labour in the exercise of his profession, as a statuary, he could only command occasional intervals, which he devoted to the study of philosophy. He soon, however, obtained the patronage of Crito, a wealthy Athenian, who engaged him in the office of instructing his children; and in this situation he availed himself of the opportunities, which were thus afforded him, of attending the public lectures of the most eminent philosophers. Ardently devoting himself to his favourite pursuits, he chose, for his first preceptor, Anaxagoras; and when he left Athens, he attached himself to Archelaus. Prodicus, the sophist, was his preceptor in eloquence, Evenus in poetry, Theodorus in geometry, and Damo in music; and he also derived considerable assistance in his education from Aspasia, a woman highly celebrated for her intellectual as well as personal accomplishments, to whose house persons of the most distinguished character resorted. So diligent and so successful was Socrates in the improvement of these advantages, that his endowments, both natural and acquired, attracted attention; and he appeared at Athens, equally distinguished as a true philosopher and a good citizen. The military valour of Socrates was no less conspicuous than the other qualities which were more adapted to a retired life; nor did he decline any service, however hazardous or difficult, which private friendship or the public interest demanded. On one occasion he preserved the life and arms of Alcibiades, when he fell wounded in an engagement, in which they were jointly concerned; and in order to encourage the rising merit of this noble youth, he declined the prize of valour, which was unquestionably due to himself, and gave his vote that it might be bestowed on Alcibiades. On another occasion, he hazarded his own life, in order to rescue Xenophon, who was left wounded on the field of battle, and carried him on his shoulders till he was out of reach of the enemy.

Socrates, declining military expeditions, settled at Athens; and he was upwards of 60 years, before he undertook to serve his country in any civil office. Accordingly he was chosen to represent his own district in the senate of 500; and though he was first treated contemptuously by his colleagues,

SOCRATES.

leagues, on account of his inexperience, he soon convinced them that in wisdom and integrity he was much their superior. No consideration could ever induce him to give a vote, or sanction a measure, that appeared to him to be contrary to justice and the laws; and in opposition to the thirty tyrants, whose proceedings seemed to him to be cruel and oppressive, he exposed even his life to danger in supporting, with undaunted firmness, the rights of his fellow-citizens; and when they issued an order to apprehend a wealthy citizen of Salamis, which he disapproved, he refused to execute it, alleging that he would rather suffer death himself, than be instrumental in inflicting it unjustly upon another. These proofs of public virtue, both in a military and civil capacity, says one of his biographers, are sufficient to entitle the name of Socrates to a distinguished place in the catalogue of good citizens. But his highest honour and praise are those which belong to him as a philosopher and moral preceptor. Observing with regret how the Athenian youth were misled, and even corrupted in their principles and taste, by the mode of teaching that prevailed among speculative philosophers and artful sophists, he determined to institute a new and more useful method of instruction. He justly conceived the true end of philosophy to be, not to make an ostentatious display of superior learning and ability in subtle disputations or ingenious conjectures, but to free mankind from the dominion of pernicious prejudices; to correct their vices; to inspire them with the love of virtue, and thus conduct them in the path of wisdom to true felicity. He, therefore, assumed the character of a moral philosopher; and, looking upon the whole city of Athens as his school, and all who were disposed to lend him their attention as his pupils, he seized every occasion of communicating moral wisdom to his fellow-citizens. He passed his time chiefly in public. It was his custom, in the morning, to visit the places made use of for walking and public exercises; at noon, to appear among the crowds in the markets or courts; and to spend the rest of the day in those parts of the city which were most frequented. Sometimes he collected an audience about him in the Lyceum, (a pleasant meadow on the border of the river Ilyssus,) where he delivered a discourse from the chair, whilst his auditors were seated on benches around him. At other times he conversed, in a less formal way, with any of his fellow-citizens in places of common resort, or with his friends at meals, or in their hours of amusement; thus making every place to which he came a school of virtue. Not only did young men of rank and fortune attend upon his lectures, but he sought for disciples even among mechanics and labourers.

The method of instruction, which Socrates chiefly made use of, was, to propose a series of questions to the person with whom he conversed, in order to lead him to some unforeseen conclusion. He first gained the consent of his respondent to some obvious truths, and then obliged him to admit others, from their relation, or resemblance, to those to which they had already assented. Without making use of any direct argument or persuasion, he chose to lead the person he meant to instruct, to deduce the truths of which he wished to convince him, as a necessary consequence from his own concessions. He commonly conducted these conferences with such address, as to conceal his design, till the respondent had advanced too far to recede. On some occasions, he made use of ironical language, that vain men might be caught in their own replies, and be obliged to confess their ignorance. He never assumed the air of a morose and rigid preceptor, but communicated useful in-

struction with all the ease and pleantry of polite conversation.

The modesty of Socrates was no less distinguished than his wisdom. He professed "to know only this, that he knew nothing;" meaning by this declaration, which he often repeated, that he had no other intention than to convince his hearers of the narrow limits of the human understanding. Far from encouraging universal scepticism, he always spoke confidently and decidedly on moral subjects; but at the same time he wished to expose to contempt the arrogance of those pretenders to science, who would not acknowledge themselves to be ignorant of any thing. He preferred moral to speculative wisdom; and therefore condemned those whose whole attention and time were occupied about abstruse researches into nature, and who took no pains to render themselves useful to mankind. His favourite maxim was, "whatever is above us, doth not concern us." He estimated the value of knowledge by its utility, and recommended the study of geometry, astronomy, and other sciences, only so far as they admit of a practical application to the purposes of human life. His great object, in all his conferences and discourses, was to lead men into an acquaintance with themselves; to convince them of their follies and vices; to inspire them with the love of virtue; and to furnish them with useful moral instructions. Cicero might, therefore, very justly say of Socrates, that he was the first who called down philosophy from heaven to earth, and introduced her into the public walks and domestic retirements of men, that she might instruct them concerning life and manners.

The moral lessons which Socrates taught, he himself diligently practised; whence he excelled other philosophers in personal merit, no less than in his method of instruction. His conduct was uniformly such as became a teacher of moral wisdom. His mind, through the whole of his life, was superior to the attractions of wealth and power. His instructions were gratuitous, and he refused rich presents, that were offered to him by Alcibiades and others, though his wife earnestly importuned him to accept them. He wanted little for his own personal accommodation. In his clothing and food, he consulted only the demands of nature. Although his fare was simple, he was hospitable; and sometimes invited men of superior rank to partake of his meals. On one of these occasions, his wife complained of the incompetency of their provision for their guests; but to these complaints he merely replied, that if his guests were wise men, they would be satisfied with the provisions which his table afforded; if otherwise, they were unworthy of notice. "Whilst others," says he, "live to eat, wise men eat to live." He knew, that temperance was conducive to health, and he found by experience that this was the case; for he escaped infection in the midst of the plague which proved so fatal to his fellow-citizens.

Although he admired a fair external form, as the index of a mind possessed, or at least capable, of moral beauty, and conversed freely with young persons of both sexes, in order to assist their progress in wisdom and virtue; yet his enemies have never been able to fix upon him the charge of incontinence. "Modern calumnies," says our biographer, "which impute to this great man vices, with which he was never charged by his contemporaries, ought to be treated with universal contempt." In his domestic connection he was unfortunate, yet he converted this into an occasion of exercising his virtue. Xantippe, of whom many tales, that are mere fabrications, are related, was without doubt a woman of a high and unmanageable spirit.

Socrates himself, however, allows that he possessed many domestic virtues; and towards the close of his life, and during his imprisonment, he expressed great affection for her husband; and, indeed, after twenty years' experience, it would have been strange, if it had been otherwise. On all occasions, however, at home and abroad, he maintained an unruffled equanimity of temper; always exercising that self-command, which is founded on virtuous principles, and strengthened by reflection and habit. In this respect he was the more praise-worthy, as he himself acknowledges, that he was, in his natural disposition, prone to vice, but that he had subdued his inclinations by the power of reason and philosophy. This divine power of reason was probably the genius, or demon, which, from time to time, gave him instruction. Without admitting every thing which his disciples have said on this subject, it is possible that Socrates might, in some degree, be influenced by superstitious credulity, concerning this demon; for Xenophon expressly attests, that he believed that the gods sometimes communicate to men the knowledge of future events, and that, on this principle, he encouraged the practice of divination.

It was one of the maxims of Socrates, "that a wife man will worship the gods according to the institutions of the state to which he belongs." He taught, however, a doctrine concerning religion much more pure and rational, than that which was delivered to the people by the priests, and he reprobated the popular fables concerning the gods. Convinced of the weakness of the human understanding, and perceiving that the pride of philosophy had led his predecessors into futile speculations on the nature and origin of things, he judged it most consistent with true wisdom to speak with caution and reverence concerning the divine nature. Nevertheless, there can be no doubt that, whilst he did not deny the existence of inferior divinities, he acknowledged the being and providence of one Supreme Deity, and paid homage, with a pious mind, to the sovereign power.

In fine, Socrates, both on account of his abilities as a moral preceptor, and on account of his personal merit, unquestionably deserves to be ranked in the first order of human beings. "The man," says Xenophon, "whose memoirs I have written, was so pious, that he undertook nothing without asking counsel of the gods; so just, that he never did the smallest injury to any one, but rendered essential services to many; so temperate, that he never preferred pleasure to virtue; and so wise, that he was able, even in the most difficult cases, without advice, to judge what was expedient and right. He was eminently qualified to assist others by his counsel; to penetrate into men's characters; to reprehend them for their vices; and to excite them to the practice of virtue. Having found all these excellencies in Socrates, I have ever esteemed him the most virtuous and the happiest of men."

Socrates, notwithstanding the superiority of his talents, the excellence of his character, and the number of his followers, who venerated and esteemed him, had many enemies. They were chiefly interested *Sophists* (see *SOPHIST*), whose influence and whose emoluments were diminished in consequence of the prevalence of his doctrines and precepts. In order to degrade him in the estimation of the Athenian youth, and to restrain his popularity, they engaged Aristophanes, the first buffoon of the age, to write a comedy, in which Socrates should be the principal character. Aristophanes, pleased with so promising an occasion of displaying his low and malignant wit, undertook the task,

and produced the comedy of "The Clouds," still extant in his works. In this piece Socrates is introduced hanging in a basket in the air, and thence pouring forth absurdity and profaneness. The philosopher, though he seldom visited the theatre, except when the tragedies of Euripides were performed, attended the representation of this play, at a time when the house was crowded with strangers, who happened to be at Athens during the celebration of a Bacchanalian festival. When the performer, who represented Socrates, appeared upon the stage, a general whisper passed along the benches on which the strangers sat, to inquire who the person was whom the poet meant to satirize. Socrates, who had taken his station in one of the most public parts of the theatre, observed this circumstance; and immediately, with great coolness, rose up, to gratify the curiosity of the audience, and continued standing during the remainder of the representation. One of the spectators, astonished at the magnanimity which this action discovered, asked him, whether he did not feel himself much chagrined, to be thus held up to public derision. "By no means," replied Socrates, "I am only a host at a public festival, where I provide a large company with entertainment."

These efforts of envy and malice, however, were not of long duration. When Aristophanes attempted, the year following, to renew the piece with alterations and additions, the representation was so much discouraged, that he was obliged to discontinue it. The consequence was, that the Sophists, and other opponents of Socrates, who appear to have made use of the expedient of the theatrical representation, in order to found the inclinations of the public, chose to postpone the farther prosecution of their malignant intention to a more favourable opportunity.

From this time, Socrates continued, for many years, to prosecute his laudable design of instructing and reforming his fellow-citizens. But as he persevered in opposing every kind of political corruption and oppression, both under the democracy and oligarchy, the number of his enemies increased, and a conspiracy, which had been long concerted against his life, was resumed. Clandestine arts were used, after the dissolution of the tyranny, to excite a general prejudice against him. The people were industriously reminded, that Critias, who had been one of the most cruel of the thirty tyrants, and Alcibiades, who had insulted religion by defacing the public statues of Mercury, and performing a mock representation of the Eleusinian mysteries, had, in their youth, been disciples of Socrates. The minds of the people being thus inflamed, a direct accusation was preferred against Socrates before the supreme court of judicature. His accusers were Anytus, a leather-dresser, who had long entertained a personal enmity against Socrates, for reprehending his avarice, in depriving his sons of the benefits of learning, that they might pursue the gains of trade; Melitus, a young rhetorician, who was capable of undertaking any thing for the sake of gain; and Lycon, who was glad of an opportunity of displaying his talents. The accusation, which was delivered to the senate under the name of Melitus, was this: "Melitus, son of Melitus, of the tribe of Pythos, accuseth Socrates, son of Sophroniscus, of the tribe of Alopece. Socrates violates the laws, in not acknowledging the gods which the state acknowledges, and by introducing new divinities. He also violates the laws by corrupting the youth. Be his punishment death."

This charge was delivered upon oath to the senate, and Crito, a friend of Socrates, became surety for his appearance on the day of trial. Anytus, soon afterwards,

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sent a private message to Socrates, assuring him, that if he would desist from censuring his conduct, he would withdraw his accusation. But Socrates refused to comply with so degrading a condition, and, with his usual spirit, replied, "Whilst I live I will never disguise the truth, nor speak otherwise than my duty requires." The interval between the accusation and the trial he spent in philosophical conversations with his friends, chusing to discourse upon any other subject, rather than his own situation. Hermogenes, one of his friends, was much struck with this circumstance, and asked him, why he did not employ his time in preparing his defence: "Because," replied Socrates, "I have never in my life done any thing unjust." The eminent orator Lyfias composed an apology, in the name of his master, which he requested him to adopt; but Socrates excused himself by saying, that though it was eloquently written, it would not suit his character.

When the day of trial arrived, his accusers appeared in the senate, and attempted to support their charge in three distinct speeches, which strongly marked their respective characters. Plato, who was a young man, and a zealous follower of Socrates, then rose up to address the judges in defence of his master: but whilst he was attempting to apologize for his youth, he was abruptly commanded by the court to sit down. Socrates, however, needed no advocate. Ascending the chair with all the serenity of conscious innocence, and with all the dignity of superior merit, he delivered, in a firm and manly tone, an unpremeditated defence of himself, which silenced his opponents, and ought to have convinced his judges. After tracing the progress of the conspiracy which had been raised against him to its true source, the jealousy and resentment of men whose ignorance he had exposed, and whose vices he had ridiculed and reformed, he distinctly replied to the several charges brought against him by Melitus. To prove that he had not been guilty of impiety towards the gods of his country, he appealed to his frequent practice of attending the public religious festivals. The crime of introducing new divinities, with which he was charged, chiefly, as it seems, on the ground of the admonitions which he professed to have received from an invisible power, he disclaimed, by pleading, that it was no new thing for men to consult the gods, and receive instructions from them. To refute the charge of his having been a corrupter of youth, he urged the example which he had uniformly exhibited of justice, moderation, and temperance, the moral spirit and tendency of his discourses, and the effect which had actually been produced by his doctrine upon the manners of the young. Then, disdainingly to solicit the mercy of his judges, he called upon them for that justice, which their office and their oath obliged them to administer, and professing his faith and confidence in God, resigned himself to their pleasure.

The judges, whose prejudices would not suffer them to pay due attention to this apology, or to examine with impartiality the merits of the cause, immediately declared him guilty of the crimes of which he stood accused. Socrates, in this stage of the trial, had a right to enter his plea against the punishment which the accusers demanded, and instead of the sentence of death, to propose some pecuniary amercement. But he, at first, peremptorily refused to make any proposal of this kind, imagining that it might be construed into an acknowledgment of guilt; and asserted, that his conduct merited, from the state, reward rather than punishment. At length, however, he was prevailed upon by his friends to offer, upon their credit, a fine of thirty *mine*. The judges, notwithstanding, still remained inexorable: they proceeded, without farther delay, to pronounce sentence

upon him; and he was condemned to be put to death by the poison of hemlock. Socrates received the sentence with perfect composure, and by a smile testified his contempt both for his accusers and his judges. Then, turning to his friends, he expressed his entire satisfaction in the recollection of his past life, and declared himself firmly persuaded, that posterity would do so much justice to his memory as to believe, that he had never injured or corrupted any one, but had spent his days in serving his fellow-citizens, by communicating to them, without reward, the precepts of wisdom. Converting in this manner, he was conducted from the court to the prison, which he entered with a serene countenance and a lofty mind, amidst the lamentations of his friends.

On the day of the condemnation, it happened that the ship, which was employed to carry a customary annual offering to the island of Delos, set sail. It was contrary to the law of Athens, that, during this voyage, any capital punishment should be inflicted within the city. This circumstance delayed the execution of the sentence against Socrates for thirty days. So long an interval of painful expectation, however, only served to afford farther scope for the display of his constancy. When his friends were with him, he conversed with his usual cheerfulness. In their absence, he amused himself with writing verses. He composed a hymn in honour of Apollo and Diana, and versified a fable of Æsop. His friends, still anxious to save so valuable a life, urged him to attempt his escape, or at least to permit them to convey him away; and Crito went so far, as to assure him that, by his interest with the gaoler, it might be easily accomplished, and to offer him a retreat in Thessaly; but Socrates rejected the proposal, as a criminal violation of the laws; and asked them, whether there was any place out of Attica which death could not reach.

News being, at length, brought of the return of the ship from Delos, the officers, to whose care he was committed, delivered to Socrates, early in the morning, the final order for his execution, and immediately, according to the law, set him at liberty from his bonds. His friends, who came thus early to the prison that they might have an opportunity of conversing with their master through the day, found his wife sitting by him with a child in her arms. As soon as Xantippe saw them, she burst into tears, and said, "O Socrates, this is the last time your friends will ever speak to you, or you to them." Socrates, that the tranquillity of his last moments might not be disturbed by her unavailing lamentations, requested that she might be conducted home. With the most frantic expressions of grief, she left the prison. An interesting conversation then passed between Socrates and his friends, which chiefly turned upon the immortality of the soul. In the course of this conversation, Socrates expressed his disapprobation of the practice of suicide, and assured his friends, that his chief support in his present situation was an expectation, though not unmixed with doubts, of a happy existence after death. "It would be inexcusable in me," said he, "to despise death, if I were not persuaded that it will conduct me into the presence of the gods, who are the most righteous governors, and into the society of just and good men: but I derive confidence from the hope, that something of man remains after death, and that the condition of good men will then be much better than that of the bad." Crito, afterwards asking him in what manner he wished to be buried, Socrates replied, with a smile, "As you please, provided I do not escape out of your hands." Then, turning to the rest of his friends, he said, "Is it not strange,

after all that I have said to convince you that I am going to the society of the happy, that Crito still thinks this body, which will soon be a lifeless corpse, to be Socrates? Let him dispose of my body as he pleases, but let him not, at its interment, mourn over it, as if it were Socrates."

Towards the close of the day, Socrates retired into an adjoining apartment to bathe; his friends, in the mean time, expressing to one another their grief, at the prospect of losing so excellent a father, and being left to pass the rest of their days in the solitary state of orphans. After a short interval, during which he gave some necessary instructions to his domestics, and took his last leave of his children, the attendant of the prison informed him, that the time for drinking the poison was come. The executioner, though accustomed to such scenes, shed tears, as he presented the fatal cup. Socrates received it without change of countenance, or the least appearance of perturbation: then, offering up a prayer to the gods, that they would grant him a prosperous passage into the invisible world, with perfect composure he swallowed the poisonous draught. His friends around him burst into tears. Socrates alone remained unmoved. He upbraided their pusillanimity, and entreated them to exercise a manly constancy, worthy of the friends of virtue. He continued walking, till the chilling operation of the hemlock obliged him to lie down upon his bed. After remaining, for a short time, silent, he requested Crito (probably in order to refute a calumny which might prove injurious to his friends after his decease), not to neglect the offering of a cock, which he had vowed to Esculapius. Then covering himself with his cloak, he expired. Such was the fate of the virtuous Socrates! a story, says Cicero, which I never read without tears.

The friends and disciples of this illustrious teacher of wisdom were deeply afflicted by his death, and attended his funeral with every expression of grief. Apprehensive, however, for their own safety, they, soon afterwards, privately withdrew from the city, and took up their residence in distant places. Several of them visited the philosopher Euclid, of Megara, by whom they were kindly received.

No sooner was the unjust condemnation of Socrates known through Greece, than a general indignation was kindled in the minds of good men, who universally regretted that so distinguished an advocate for virtue should have fallen a sacrifice to jealousy and envy. The Athenians themselves, so remarkable for their caprice, who never knew the value of their great men till after their death, soon became sensible of the folly, as well as criminality, of putting to death the man who had been the chief ornament of their city, and of the age, and turned their indignation against his accusers. Melitus was condemned to death, and Anytus, to escape a similar fate, went into voluntary exile. To give a farther proof of the sincerity of their regret, the Athenians, for a while, interrupted public business; decreed a general mourning; recalled the exiled friends of Socrates; and erected a statue to his memory in one of the most frequented parts of the city. His death happened in the first year of the ninety-sixth Olympiad, and in the 70th year of his age. Brucker's Hist. Phil. by Enfield, vol. i.

SOCRATES, an ecclesiastical historian, was born and educated at Constantinople; and having studied under the grammarians Helladius and Ammonius, he commenced his career at the bar. But after some time he relinquished the profession of a law-pleader, and engaged in writing his ecclesiastical history, which comprehends, in seven books, the interval of about 133 years, from the year 306, when Con-

stantine was declared emperor, to the seventeenth consulship of Theodosius, A.D. 439, in which year Cave represents him as flourishing. Socrates, Sozomen, and Theodoret, may be considered as continuators of Eusebius of Cæsarea; and these three writers, who lived in the time of Theodosius the younger, whose reign extended from the year 408 to 450, published their respective histories, which are valuable monuments of antiquity, about the same time, near the end of this reign. Socrates seems to have been distinguished by his moderation and candour, which we may infer from the freedom with which he censures the squabbles and contentions that subsisted amongst the Christian clergy in those times, and condemns the persecution that occurred in the reign of Julian. From the candid manner in which he expresses his sentiments concerning the Novatians, some persons have erroneously concluded that he was one of their number.

As an historian, Socrates has the merit of being judicious in his observations upon men and things, and generally accurate in his chronology. He speaks with great respect of the scriptures of the Old and New Testaments; and has expressly quoted the Acts of the Apostles, and the Epistles to the Romans, the Corinthians, the Galatians, the Colossians, and the Hebrews: he likewise takes notice of a various reading in 1 John, iv. 3. The work of Socrates was translated into Latin by those who made versions of the other Greek ecclesiastical historians, and is usually printed with them. The best editions are those of Valerius, fol. Paris, 1668, and of Reading, fol. Cant. 1720. Dupin. Lardner.

SOCRATIC INDUCTION, in *Rhetoric*. See INDUCTION.

SOCRATIC *Philosophy*, the doctrines and opinions, with regard to morality and religion, maintained and taught by Socrates.

As Socrates left nothing in writing, we are indebted to his illustrious pupils, Xenophon and Plato, for what is known both of his opinions and manner of teaching; and more especially to the former, whose memoirs of Socrates contain more accurate information than the dialogues of Plato, because he intermixes his own conceptions and diction with the ideas and language of his master. Accordingly it is related, that when Socrates heard Plato recite his *Lysis*, he said, "How much does this young man make me say, which I never conceived!" The distinguishing character of Socrates was that of a moral philosopher; and to this purpose Xenophon denies that he ever taught natural philosophy, or any mathematical science, and charges with misrepresentation and falsehood those who had ascribed to him dissertations of this kind, probably in this charge referring to Plato, in whose works Socrates is introduced as discoursing on these subjects.

The doctrine of Socrates concerning God and religion is rather practical than speculative. But he did not neglect to build the structure of religious faith upon the firm foundation of an appeal to natural appearances. He taught, that the Supreme Being, though invisible, is clearly seen in his works, which at once demonstrate his existence, and his wise and benevolent providence. This point is established, with great perspicuity and force of reasoning, in his conferences with Aristodemus, and with Euthydemus. "Reflect," says he, "that your own mind directs your body by its volitions, and you must be convinced that the intelligencer of the universe disposes all things according to his pleasure.—Can you imagine, that your eye is capable of discerning distant objects, and that the eye of God cannot, at the same instant, see all things; or that, whilst your mind contemplates the affairs of different countries, the understanding of God cannot

not attend, at once, to all the affairs of the universe? Such is the nature of the Divinity, that he sees all things, hears all things, is every where present, and constantly superintends all events." Again: "He who disposes and directs the universe, who is the source of all that is fair and good, who, amidst successive changes, preserves the course of nature unimpaired, and to whose laws all beings are subject, this Supreme Deity, though himself invisible, is manifestly seen in his magnificent operations. Learn, then, from the things which are produced, to infer the existence of an invisible power, and to reverence the Divinity."

Besides the one Supreme Deity, Socrates admitted the existence of beings who possess a middle station between God and man, to whose immediate agency he ascribed the ordinary phenomena of nature, and whom he supposed to be particularly concerned in the management of human affairs. Hence, speaking of the gods, who take care of men, he says, "Let it suffice you, whilst you observe their works, to revere and honour the gods: and be persuaded, that this is the way in which they make themselves known; for, among all the gods, who bestow blessings upon men, there are none who, in the distribution of their favours, make themselves visible to mortals." Hence, he spoke of thunder, wind, and other agents in nature, as servants of God, and encouraged the practice of divination, under the notion, that the gods sometimes discover future events to good men.

Concerning the human soul, the opinion of Socrates, according to Xenophon, was, that it is allied to the divine being, not by a participation of essence, but by a similarity of nature; that man excels all other animals in the faculty of reason; and that the existence of good men will be continued after death, in a state in which they will receive the reward of their virtue. Although it appears that, on this latter topic, Socrates was not wholly free from uncertainty, the consolation which he professed to derive from this source in the immediate prospect of death, leaves little room to doubt, that he entertained a real belief and expectation of immortality. The doctrine which Cicero ascribes to Socrates, on this head, is, that the human soul is a divine principle, which, when it passes out of the body, returns to heaven; and that this passage is most easy to those who have, in this life, made the greatest progress in virtue.

The system of morality which Socrates made it the business of his life to teach, was raised upon the firm basis of religion. The first principles of virtuous conduct, which are common to all mankind, are, according to this excellent moralist, laws of God: and the conclusive argument by which he supports this opinion is, that no man departs from these principles with impunity. "It is frequently possible," says he, "for men to screen themselves from the penalty of human laws, but no man can be unjust, or ungrateful, without suffering for his crime: hence, I conclude, that these laws must have proceeded from a more excellent legislator than man." Socrates taught, that true felicity is not to be derived from external possessions, but from wisdom, which consists in the knowledge and practice of virtue; that the cultivation of virtuous manners is necessarily attended with pleasure, as well as profit; that the honest man alone is happy; and that it is absurd to attempt to separate things, which are in nature so closely united as virtue and interest.

But it is impossible, says the author whom we are citing, in detached sentences, to give the reader any tolerable idea of the moral doctrines of Socrates. We must therefore refer him, on this head, to that valuable treasure of ancient wisdom, the "Memorabilia" of Socrates; a work in which he will find his original conversations on many interesting topics,

related with that beautiful simplicity, which distinguishes the writings of Xenophon.

The followers of Socrates may be divided into three classes. The first class consists of such as were neither philosophers by profession, nor addicted to the study of philosophy, but attended upon Socrates as a moral preceptor, for the purpose of correcting and improving their manners. Among these were several young men of the first rank in Athens, particularly Alcibiades and Critias. In this class may also be placed the poets Euenes and Euripides, and the orators Lyfias and Isocrates. The second class included all those who, after his death, became founders of particular sects, and, though they differed from each other greatly, were united under the general appellation of Socratic philosophers. These were Arillippus, the founder of the Cyrenaic sect; Phædo, of the Eliac; Euclid, of the Megaric; Plato, of the Academic; and Antisthenes, of the Cynic. The third class comprehends those disciples of Socrates, who, though their names are found in the catalogue of philosophers, did not institute any new sect. The most distinguished disciples of the Socratic school are Xenophon, Æschines, Simon, and Cebes; for an account of whom, see their respective articles. Brucker's Hist. of Phil. by Enfield, vol. 1.

SOCRATIS INSULA, in *Ancient Geography*, an island of the Arabic gulf, on the coast of Arabia Felix. Ptolemy.

SOCUNDA, a town of Hyrcania, according to Ammianus Marcellinus, named Socanaa by Ptolemy, who places it on the coast of the Caspian sea, between the mouths of the rivers Maxera and Oxus.

SOD, in *Agriculture*, a portion of turf or sward, cut or dug up. It also signifies the soil or earth. The square pieces of surface-turf and earth that are cut up in forming embankments and earth-fences are likewise termed fods, and require nice cutting, so as to be exactly joined in performing the works. Sods are useful too in some other operations of the rural kind.

SOD-BURNING, the practice of paring off the sward or mossy surface of the land. It is observed by Mr. Marshall, in the Rural Economy of West Devonshire, that the most noticeable particular of management in the soil process of that district, is that of "burning beat," as it is provincially termed; answering to the paring and burning, or more technically, sod-burning, of other districts; and that this operation in agriculture has been practised, in this western part of the island, from time beyond which memory or tradition reaches. It has, he conceives, probably been imported from the opposite shore of the continent. And in an old tract, which he saw some years ago in the British Museum, this operation is termed *Devonshiring*, and it is to this day called *Denshiring*, in different districts of the kingdom. He also further states, that there are at present three distinct methods of separating the sward or sod, provincially the "spine," from the soil. The one is performed with a "beating-axe," namely, a large adze, some five or six inches wide, and ten or twelve inches long, crooked, and somewhat hollow, or *disbing*. With this, which was probably the original instrument employed in the operation, large chips, shavings, or fods, are struck off. It is still used in rough uneven grounds, especially where furze, or the stubs of brushwood abound. In using it, the workman appears to the eye of a stranger, at some distance, to be *beating* the surface as with a beetle, rather than to be chipping off the sward with an edged tool. This operation is provincially termed "hand-beating." The next instrument in use is, he says, the spade, resembling the paring spade, or breast-plough of other districts; with, however, in some instances at least, a notable addition, namely, a mould-board, fixed in such a manner as

to turn the sod or turf as a plough turns the furrow-slice, thus becoming literally a breast-plough; a name which has probably been given to the implement in this state, and continued to be applied to the spade or share after the mould-board was laid aside.

It is added, that in working this tool, the labourer proceeds without stopping to divide the sods into short lengths; this part being done by women and children, who follow to break the turfs into lengths, and set the pieces on edge to dry. The price for "spading" is about three halfpence a square perch, of eighteen feet, or 16s. or 17s. a statute acre. Formerly, it is probable, this instrument was much used, but at present it appears to be chiefly in the hands of small farmers.

It is stated, that the instrument at present used for separating the spine or grassy turf from the soil, by farmers in general, is the common team-plough, with some little alteration in the size and form of the share, according to the fancy or judgment of the farmer or his ploughman, there being two different ways of performing the operation. The one is termed "velling," the other "skirting," or "skirwinking." In that for *velling*, the share is made wide, with the angle or outer point of the wing or fin turned upward to separate the turf entirely from the soil. But in that for *skirting*, the common one is used, but made perhaps somewhat wider than when it is used in the ordinary operation of ploughing. And that in this mode of using the plough, little more than half the sward is pared off, turning the part raised upon a line of unmoved turf; as in the operation of ribbing, rice-balking, raftering, or half-ploughing. The paring of turf in this case is from one to two inches thick on the coulter margin, decreasing in thickness to a thin feather edge, by which it adheres to the unmoved sward. And after having lain some time in this state to rot, or grow tender, it is pulled to pieces with rough harrows drawn across the lines of turf; and having lain in this rough state until it be sufficiently dry, it is bruised with a roller, and immediately harrowed with light harrows, walking the horses one way, and trotting them another, to shake the earth out more effectually from among the roots of the grass; going over the ground again, and perhaps again, according to the season, and the judgment of the manager, until most of the earth be disengaged. The "beat" of fragments of turfs being sufficiently dry, is gathered into heaps of five or six bushels each; either with the "drudge," first into rows, and then drawing it along the rows into heaps; or is pulled together with long-toothed hand-rakes, adapted to the purpose. The former is more expeditious, and requires fewer hands; the latter gathers the beat cleaner, freer from earth, which is liable to be drawn together by the drudge. The "beat burrows" or heaps being rounded, and shooed up light and hollow, a wisp of rough straw, a large handful, is thrust, double, into the windward side of each heap; and a number of heaps being thus primed, a match or flambeau is formed, with "reed" or straight unthrashed straw, one end of which being lighted, it is applied in succession to the loose ragged ends of the wisp of straw, which readily communicate the fire to the heaps. The centre of the heap being consumed, the outskirts are thrown lightly into the dimples or hollows, and the heaps rounded up, as at first, continuing to right up the burrows, until the whole of the beat be consumed, or *changed*, by the action of the fire. And the produce of the first skirting being burnt and spread over the surface, the operation is sometimes repeated by running the plough across the lines of the first skirting; thus paring off the principal part of the spine; again dragging, rolling, harrowing, collecting, and burning, as in the former operation. This is a process

of very great importance in the system of Devonshire husbandry, and by which vast advantages and improvements have been effected.

The practice is not now, however, had so much recourse to as formerly, probably on account of its having been carried to too great a length in some cases, and improper modes of cropping having been pursued after it in others; but where well understood, it is still an excellent method of preparation in many instances and situations of land. The great advantages of it seem to consist in the reduction and diminution, which it so readily affords to the more stiff, adhesive, tenacious, clayey sorts of soils; and the quick, certain, and effectual manner in which it brings the inert and useless vegetable matters of them, into more proper states for the purpose of supporting plants, in the way of manures, as crops.

It is most likely that this practice will be the most beneficial in all such soils as contain an over-proportion of dead fibrous vegetable matter, or which lose from about one-third to one-half of their weight by burning; and in all such as contain their earthy constituent parts in a finely reduced state of division, such, for instance, as strong clays, marles, and some other similar kinds: but that in light, coarse, sandy, and rich soils of other qualities, which contain proper proportions of earthy matters in their composition; and in every case where the structure and qualities of them are in their present states properly loose, and the organizable matters in them properly and to a sufficient extent soluble, this practice cannot be employed with success, though it is sometimes attempted upon them. The siliceous poor sandy soils must always, it is supposed, be greatly hurt by it, as is evident from the practical results upon such lands.

It is not improbable, but that in numerous cases it may have failed, in consequence of over-burning the turf, or some other mismanagement in the practice, as there may, by such means, be too great a dissipation and waste of some certain substances and matters, which are in their nature and properties not only necessary, but highly conducive to the fertility and improvement of the soil or land. That carbon, or the refuse of burnt vegetable matters, is of this nature, there can now be no doubt, as the decomposition of such substances has fully shewn it. This material may, therefore, be too much carried off and destroyed in burning the turf of lands, either by combining too freely with the oxygen of the surrounding atmosphere, in consequence of too great a heat being kept up in the operation, and be thereby lost in the form of carbonic acid gas; or by combining in too free a manner with certain proportions of hydrogen, supplied by the vegetable matter in consequence of the increased heat, and by this means furnishing a sort of oleaginous fluid, which is dissipated in large quantities with great rapidity, when a considerable extent of surface is exposed to the air of the atmosphere, during the time of burning the turf. It is therefore evident, on these as well as other accounts, that a slow dull smothering fire, and as small an exposure to the open air as possible, are both circumstances particularly necessary to the proper effect and success of this practice in many cases, if not in all; as when these and such like circumstances are not well attended to and properly regulated, the ashes and other matters which are produced, will be, in a great measure, deprived and destitute of those fertilizing and enriching qualities and properties, which are so necessary and essential to substances of this kind. See PARING and BURNING.

Sod-Drain, that sort of drain which is formed and constructed either wholly, or in the greatest part, of the sods dug

dig up from the land about them. These forts or drains were formerly much in use, and thought highly of in some districts and places, most likely on account of their cheapness; but they are now fallen into neglect and disrepute, probably in consequence of their want of security and durability, especially in lands which are under the plough. They are, however, still made use of occasionally on pasture and sward lands in some situations. The methods of making them differ in different cases and circumstances, according to the nature and kinds of land, being in some instances formed with much more solidity than in others, as may be seen under the articles *SURFACE-DRAINS* and *DRAINING*. They can perhaps, on the whole, be seldom had recourse to with propriety, except in cases where other kinds of more solid materials are procured with great difficulty.

SOD-Fence, any sort of fence which is constructed of materials of this nature, either for inclosing land or defending it against the waters of rivers or the sea. See *FENCES*.

These kinds of fences, when made against the sea or large rivers, should have a good degree of slope, as two, three, or four feet, to one in height, according as the case may be. They have in some districts, as in Lancashire, in many instances, a base of about forty feet, and slope upwards in the direction of the sea as well as that of the land. The extent of base is, however, different in different places, as well as that of the slope or slopes. Fences of this nature against the sea in the above county, cost about 3*l.* the rod of eight yards in their construction.

SOD-Kiln, any sort of kiln which is built or constructed with fods, for the purpose of burning lime or any other material of that kind. They are very common in some places. See *KILN*.

A very close sort of smothering heat is produced in this way, which readily converts any calcareous matters into lime of a good quality for use on land.

SOD-Knife, Draining, an implement of the knife kind, which is made use of with great advantage in scoring and cutting out the sward or grassy surface in forming drains. It is a very useful tool, performing the work in a neat manner.

SODA. See *SODIUM*.

SODA, in the *Materia Medica*. *Muriate of Soda*. See *MURIATE of Soda*, *SALT*, and *SALTS*. It is observed, (see Thomson's Chemistry, cited by Mr. A. T. Thomson in the London Dispensatory,) that the common salt of commerce contains small portions of muriate of magnesia, muriate of lime, and sulphate of lime; and for the separation of these, the salt is to be dissolved in four times its weight of pure water, and into the filtered solution must be dropped first muriate of barytes, and then subcarbonate of soda, as long as any precipitate falls. Then filter and evaporate the clear fluid slowly till the salt crystallizes, which is pure muriate of soda. This pure muriate of soda is inodorous; its taste is strictly salt; and, when pure, perfectly devoid of any degree of bitterness. It is in regular cubes, which are not affected by exposure to the atmosphere. When it deliquesces, it contains muriate of magnesia. Its crystals decrepitate when heated; and in a red heat melt, losing about two *per cent.* of their weight; and in a still greater heat the salt is volatilized, undecomposed, in white fumes. Its specific gravity is 2.126. It is equally soluble in cold and in hot water, nearly three parts of either being required to dissolve one of salt. It consists, according to Kirwan, of 38.88 of acid, 53.00 soda, and 8.12 water in 100 parts. It is decomposed by sulphuric acid and nitric acid.

As an article of the *Materia Medica*, this salt is tonic and anthelmintic in moderate doses; purgative in larger;

and externally stimulant. In the ordinary mode of using it, the tonic power of salt operates in assisting the process of digestion; and, consequently, taken more freely, it proves useful in dyspepsia, and in correcting the weakened state of the intestines, which favours the propagation of worms. In large doses it is said to check vomiting of blood, and may be used as a purgative; although it is seldom employed. But the purgative quality of sea-water does not altogether depend on this salt, as it contains a much larger proportion of muriate of magnesia, which is also purgative. As a local stimulant, its solution in tepid water, in the proportion of ℥ss or ℥j to o*j* of water, forms the common domestic enema. It is used also as a fomentation to sprains and bruises; and dissolved in a large proportion of water, forms the best stimulant general bath, whether used cold, or in a tepid, or a hot state.

With a view to the first intentions, the dose of muriate of soda may be from grs. x to ℥j; but to operate by stool from ℥ss to ℥j is necessary, largely diluted.

The official preparations of this salt are as follow; *viz.* "dried muriate of soda," which is prepared, according to the Dub. Ph., by taking any quantity of muriate of soda, and roasting it over the fire in an iron vessel, slightly covered, until it ceases to decrepitate, occasionally agitating. According to Kirwan, 100 parts of crystallized muriate of soda contain 8.12 of water, which are nearly dissipated by the heat, and the salt is thus rendered of a more uniform strength. It is chiefly employed for the distillation of *MURIATIC Acid*, (see that article,) which is obtained colourless from the dried salt.

Muriatic acid of the Lond. Ph. is prepared by first mixing 1½*lb.* of sulphuric acid with half a pint of distilled water in a glass retort, and when the mixture is cold, adding to it 2*lbs.* of muriate of soda dried: then pouring a pint of the water into the receiver, and having fitted to it the retort placed in a sand-bath, distil over the muriatic acid into this water, with a heat gradually raised, until the retort becomes red-hot. The specific gravity of muriatic acid is to that of distilled water as 1.170 to 1.000. If a piece of limestone be immersed in a fluid-ounce of it, diluted with water, the quantity dissolved ought to be half an ounce. The Edinb. Ph. directs the *muriatic acid* to be prepared by first exposing 2*lbs.* of muriate of soda in a pot to a red heat for a short time, and when it is cold, putting it into a retort; then pouring 16 oz. of sulphuric acid, mixed with 1*lb.* of water, and cooled, upon the muriate of soda; and finally distilling from a sand-bath with a moderate fire, as long as any acid comes over. The specific gravity of this acid is to that of distilled water as 1.170 to 1.000. According to the Dubl. Ph. 6*lbs.* of sulphuric acid are diluted with the same quantity of water; and after it is cold, it is added gradually to 6*lbs.* of muriate of soda, dried and put into a glass retort; and then the liquor is distilled until the residuum becomes dry. The specific gravity of this acid is to that of distilled water as 1.170 to 1.000.

This acid, for a farther account of which see *MURIATIC Acid*, is tonic and antiseptic. It has been used with effect in typhus fevers, and in some cutaneous eruptions. It is a common and useful addition to gargles, in the proportion of from ℥ss to ℥ij in ℥vj of any fluid, in ulcerated throats and cancrum oris; and in a very highly diluted state, ℥viij in ℥ziv of water, it has been recommended as an injection in gonorrhœa. It has also been regarded as an antidote in general syphilitic affections; but this opinion has been shewn by Mr. Pearson to be erroneous: nevertheless, by its salutary effect on the stomach and general health, it is capable of ameliorating the appearance of venereal ulcers, and of restraining for a time the progress of the disease, when

when it is desirable to gain time previously to the commencement of a mercurial course. The dose is from ℥x to ℥xx, in a sufficient quantity of water. Morveau, in 1773, discovered the important power of muriatic acid, in the state of gas, for neutralizing putrid miasmata; and thus it is used as an agent for destroying infection in sick rooms and hospitals, disengaged by pouring sulphuric acid on common salt.

The officinal preparations of muriatic acid are as follow; "muriate of barytes" (see SALTS): the "solution of muriate of lime" (see LIME and MURIATE of Lime), which, according to the Edinb. Ph., is prepared by mixing 16 oz. of muriatic acid with 8 oz. of water, and gradually adding 9 oz. of the harder variety of carbonate of lime (*viz.* white marble) broken into small pieces: when the effervescence is finished, digest for an hour; then pour off the fluid, and reduce it by evaporation to dryness: dissolve the residuum in its weight and a half of water, and filter the solution. This "water of muriate of lime" is prepared, according to the Dubl. Ph., by adding gradually 2 oz. of diluted muriatic acid to 1 oz. of chalk reduced to a coarse powder, and when the effervescence is finished, filtering the solution. This solution is colourless, and has a disagreeable, bitter, acrid taste; it is decomposed by the sulphuric, nitric, phosphoric, fluoric, and boracic acids; the neutral salts into which these enter; and the alkalies and alkaline carbonates which precipitate the lime. In the solid state, 100 parts of muriate of lime, after being exposed to a red heat, consist of 42 of acid, 50 of lime, and 8 of water. By mixing four parts of it with an equal quantity of snow, a degree of cold is produced capable of sinking the mercury in the thermometer from 32° to 40° below 0° of Fahrenheit. Muriate of lime is deobstruent and tonic. Fourcroy introduced it into practice, and it has been much recommended as a remedy in scrophulous and glandular diseases. Mr. T. Thomson says, that he has given it with evident advantage in bronchocele, and that he has witnessed greater benefit resulting from the continued use of it in the varied forms of scrophula, than from any other remedy with which he is acquainted. Its operation is similar to that of muriate of barytes: but the danger of an over-dose is less to be dreaded, and its good effects are more uniform and certain. The dose of the solution is from ℥xx to fʒj, in a sufficient quantity of water, repeated twice or thrice a day.

Another preparation of muriate of soda is "muriate of antimony." (See ANTIMONY) For an account of the "precipitated submuriate of mercury," and of the "ammoniated submuriate of mercury," see MERCURY.

The *sub-borate of soda*, (for the chemical properties of which see BORAX,) purified by solution and crystallization, is inodorous, and has a styptic, cool, and alkalescent taste; and as an article of the materia medica, it is refrigerant and detergent. It is not given internally; and its chief application is in aphthous affections of the mouth, and excessive salivation. It is used either in the form of powder mixed with sugar, or dissolved in water, and united with honey as a lotion. See HONEY.

The *carbonate of soda* is prepared, according to the Lond. Ph., by adding 3 oz. of subcarbonate of ammonia to a solution of 1 lb. of subcarbonate of soda, in a pint of distilled water; then exposing the mixture in a sand-bath to a heat of 180° for three hours, or until the ammonia be expelled, and finally setting it apart to crystallize. The residuary liquor may be evaporated in the same manner, and set apart again to crystallize. This salt does not appear to possess any advantages superior to those of the subcarbonate as a remedy, and may therefore be regarded as a redundant preparation.

The *subcarbonate of soda* of the Lond. Ph. is prepared by boiling 1 lb. of impure soda (barilla) powdered, in a gallon of boiling distilled water for half an hour, and filtering the solution; then evaporating it to two pints, and setting it apart for crystallization: the liquor that remains is thrown away. The *carbonate of soda* of the Edinb. Ph., formerly "purified fixed fossile alkali," is prepared by bruising any quantity of impure carbonate of soda (see CARBONATE of Soda), and then boiling it in water until all the saline matter be dissolved; then filtering the solution through paper, and evaporating it in an iron vessel, so that after refrigeration crystals may be formed. The Dubl. Ph. directs 10 lbs. of powdered barilla to be boiled in two gallons of water, in a covered vessel, for two hours, with occasional stirring; filtering the liquor; then bruising the barilla that remains with an equal quantity of water, and again boiling it, which may be repeated a third time. The leys being filtered and mixed, evaporate them to dryness in a wide iron vessel, taking care that the saline mass which will remain be not again liquefied by too great a heat; stir it with an iron spatula till it becomes white; finally dissolve it in boiling water, and, after due evaporation, set it apart, that as it cools, crystals may form. These will be purer if the barilla before each boiling be exposed for some time to the air. The crystallization should be effected when the air is at the freezing temperature, and in a liquor the specific gravity of which is, to that of water, as 1220 to 1000. If the salt be not very pure, repeat the solution and crystallization.

Barilla, besides the subcarbonate of soda, contains sulphate and muriate of soda, charcoal, lime, magnesia, argil, and silix, from which these processes are intended to separate it. One pound of barilla yields from ʒij to ʒv of the crystallized subcarbonate.

A very pure subcarbonate of soda is now manufactured, on a great scale, by the decomposition of sulphate of soda and of muriate of soda, which will probably supersede altogether the processes ordered in the pharmacopœias.

Subcarbonate of soda has a mild alkalescent taste, and changes the vegetable blue and red colours to green. Its crystals are large transparent octohedrons, truncated at the summits of the pyramids, which effloresce when exposed to a dry air, and crumble down into a white opaque powder. It undergoes the watery fusion; is soluble in two parts of water at 60°, and in considerably less than its weight of boiling water, its abundant water of crystallization assisting the solution of the salt at that temperature. Its constituents, according to the late analysis of D'Arcet, are, in 100 parts, 16.04 of acid, 20.85 of alkali, and 63.61 of water: which corresponds with the statement of Bergman.

This salt is antacid and deobstruent. It is less acrid than the subcarbonate of potash; and hence is in more general use in dyspepsia and acidities of the stomach, and in scrophulous affections. Its use has been lately strenuously recommended in hooping-cough, the protraction of which it is said to prevent. It is given, at first, after the stomach and bowels have been duly evacuated, in combination with ipecacuanha and opium, and afterwards, when the violence of the cough has abated, with myrrh. The dose of this salt is from grs. x to ʒss, given twice or thrice a day, in conjunction with bitters or rhubarb.

The officinal preparations are, "dried subcarbonate of soda" of the Lond. and "dried carbonate of soda" of the Dub. Ph.; "carbonate of soda" of the Lond. Ph.; "water of the supercarbonate of soda" of the Ed. Ph.; "phosphate of soda" of the Ed. and Dub. Ph.; "soda tartarizata" of the Lond. Ed. and Dub. Ph.; "carbonate of iron" of the Lond. Ed. and Dub. Ph.; "carbonate of ammonia," and "water of carbonate of ammonia," of

the Dub. Ph.; "precipitated chalk" of the Dub. Ph.; and "benzoic acid" of the Ed. Ph.

The "dried subcarbonate of soda" of the Lond. Ph. is prepared by exposing 1lb. of subcarbonate of soda to a moderate heat in a clean iron vessel, until it becomes perfectly dry, and at the same time stirring it diligently with an iron spatula, and finally rubbing it into a powder. The Dubl. Ph. directs the "dried carbonate of soda" to be prepared by liquefying the crystals of carbonate of soda in a silver crucible over the fire; then, in an augmented heat, stirring the dissolved salt, until by the evaporation of the water it becomes dry; reducing it to a fine powder, and preserving it in stoppered phials. The constituents of 100 parts, in this state, according to the analysis of Kirwan, are 40.14 of acid, and 59.86 of soda. Dr. Beddoes has extolled this salt in form of pills, as a remedy in calculous affections; and, as Thomson says, it certainly affords decided relief from the painful symptoms attending calculus in the kidneys, and other urinary affections. Its effects, however, are only palliative, and depend on its destroying the prevalent acid in the stomach; and hence it cannot, in strict language, be regarded as a lithontriptic. The dose is from grs. x to grs. xv, given three times a day. Beddoes directed it to be combined with soap and aromatics.

The "water of supercarbonate of soda" of the Ed. Ph. is to be prepared from 10lbs. of water, and 2 oz. of subcarbonate of soda, in the same manner as the water of supercarbonate of potash. This preparation is milder and pleasanter than the water prepared with subcarbonate of potash. It is manufactured in large quantities, on a great scale, of a much superior quality to any which the apothecary can prepare: and is in very general use as a cooling beverage. Half a pint of it poured over two table-spoonfuls of lemon-juice, sweetened with a little sugar, forms an excellent and very agreeable effervescing draught.

The "phosphate of soda" is prepared, according to the Ed. Ph., by mixing 10 lbs. of powdered bones, reduced to whiteness, with 6 lbs. of sulphuric acid, in an earthen vessel; then adding 9 lbs. of water, and again mixing; keeping the vessel in a vapour-bath for three days; afterwards diluting the matter with 9 lbs. more of boiling water, and straining through a strong linen cloth, pouring boiling water gradually over it, until the whole of the acid be washed out. Set the strained liquor apart, that the impurities may subside, from which pour it off, and evaporate it to 9 lbs. To this liquor separated from its impurities, and heated in an earthen vessel, add a warm solution of carbonate of soda, until the effervescence ceases: then strain, and set the liquor aside that crystals may form. These being removed, add to the liquor, if necessary, a little carbonate of soda, that the phosphoric acid may be accurately saturated; and dispose it, by evaporation again, to yield crystals, as long as these shall be produced. Finally, let the crystals be preserved in a well-closed vessel.

The Dub. Ph. directs to take of burnt bones, reduced to powder, 5 lbs.; sulphuric acid, 3½ lbs. Mix the powder with the sulphuric acid in an earthen vessel; add, gradually, five pints of water, and agitate the mixture. Digest for three days, adding from time to time more water, lest the materials should become dry, and continue the agitation; then pour over them five pints of boiling water, and strain through a linen rag, pouring on, at intervals, boiling water, until all the acid be washed out. Set the liquor apart, that the impurities may subside, from which decant it, and evaporate it to one half; then add 3 lbs. 10 oz. of carbonate of soda, dissolved in a sufficient quantity of warm water; filter, and obtain crystals by re-

peated evaporation and cooling. The crystals are to be preserved in well-closed vessels:

If the salt be not sufficiently pure, repeat the solution and crystallization.

A cheaper mode of preparing this salt has been given by M. Funcke, a German chemist. He adds to the matter of calcined bones diffused in water, just enough dilute sulphuric acid to saturate the small portion of carbonate of lime it always contains. When the effervescence ceases, the whole is dissolved in nitric acid, and as much sulphate of soda added to the solution as of bone-ashes used. The whole is then distilled, to recover the nitric acid; and the phosphate of soda is separated from the residue, which is a mixture of sulphate of lime and phosphate of soda, by solution and crystallization.

This salt has a purely saline taste, resembling very much that of common salt. Its crystals are large, regular, transparent, rhomboidal prisms, terminated by three-sided prisms, having a specific gravity of 1.333, and efflorescing on exposure to the air. It is soluble in three parts of water at 60°, and in two parts of boiling water; and undergoes the watery fusion when heated. Its constituents, according to Thenard, are, in 100 parts, 19 of soda, 15 of phosphoric acid, and 66 of water. Muriate of barytes, lime, and magnesia, decompose this salt; and by the strong acids it is converted into superphosphate of soda.

Phosphate of soda is a mild cathartic, excellently adapted for children, and others who have a fastidious taste. It may be given dissolved in gruel or broth, made without salt, by which its taste is very effectually covered. The dose is from ʒvj to ʒij. It was introduced into practice by Dr. George Pearson of London.

The "sulphate of soda" is for the most part artificially prepared, and chiefly in the large way, during the manufacture of sal ammoniac from sulphate of ammonia and common salt. The directions given for preparing it, in the Lond. Ph., are as follow: Take of the salt which remains after the distillation of muriatic acid, 2 lbs.; boiling water, 2½ pints. Dissolve the salt in the water; then add gradually as much subcarbonate of soda as will saturate the acid. Boil the solution until a pellicle appears; and after having filtered it, set it apart to crystallize. Pour the water from off the crystals, and dry them on bibulous paper. The "sulphate of soda" of the Edinb. Ph., formerly "Glauber salts," (see GLAUBER Salt,) is formed by dissolving in water the acidulous salt, which remains after the distillation of muriatic acid, and having mixed with it carbonate of lime (chalk) in powder, to remove the superfluous acid, setting it apart until the impurities subside; then, having poured off the liquor, filtering it through paper, and reducing it by evaporation, that it may crystallize. The Dub. Ph. directs to dissolve the salt, which remains after the distillation of muriatic acid, in a sufficient quantity of boiling water; then to evaporate the filtered solution to a proper point, and set it apart, that, as it slowly cools, crystals may be formed. The taste of this salt is at first simply saline, but afterwards very disagreeably bitter. Its crystals are transparent, six-sided, irregular, channelled prisms, with dihedral summits; efflorescent, and falling to a white powder, when exposed to the air. It is soluble in 2.86 parts of water at 60°, and 0.8 of boiling water; undergoes the watery fusion when heated, and in a strong heat is partially decomposed. According to Kirwan, 100 parts contain 23.52 of acid, 18.48 of alkali, and 58.00 of water; and in the dried state, of 56 of acid, and 44 of water. This salt is a very common and useful purgative; but, on account of its nauseous taste, is not very generally pre-

scribed by the physician. The dose is from ʒfs to ʒij; but in the efflorescent state, half of these quantities is sufficient.

The "tartarized soda" (see CARBONAT of Soda and NATRON) is prepared, according to the Lond. Ph., by dissolving 20 oz. of subcarbonate of soda in 10 pints of boiling water, and adding gradually 2 lbs. of supertartrate of potash in powder; filtering the solution through paper; then boiling till a pellicle is formed on the surface, and setting it aside to crystallize; then pouring off the water from the crystals, and drying them on bibulous paper.

The "tartrate of potash and soda," formerly *Sal Rupelemensis* (which see), is prepared, according to the Edinb. Ph., from carbonate of soda and supertartrate of potash, in the same manner as TARTRITE of Potash; which see.

The "tartrate of soda and kali," of the Dub. Ph., is formed by dissolving 20 oz. of carbonate of soda in 10 pints of boiling water, and gradually adding 2 lbs. of crystals of tartar, reduced to a very fine powder; filtering the solution through paper, evaporating it, and setting it aside, that, as it slowly cools, crystals may be formed. Mr. T. Thomson observes, that of the three appellations of this salt, that of the Dublin college is the least exceptionable; the London name conveying an evidently erroneous notion of the preparation, and the Edinburgh college incorrecly denominating it a tartrate.

This salt has a bitter saline taste. Its crystals are large, regular, transparent, hard, rhomboidal, six-sided prisms; very slightly efflorescent, and soluble in five parts of water at 60°. It is decomposed by the strong acids, muriate of barytes, lime, and by a red heat. The constituents of 100 parts of this salt, according to Schulze, are 41.3 of tartaric acid, 14.3 of potash, 13.3 of soda, and 31.1 of water.

Tartrate of potash and soda is a cooling and not very unpalatable cathartic. It was introduced into practice by M. Seignette, an apothecary of Rochelle, and the preparation kept a secret until it was discovered and published by Boulduc and Geoffrey in 1731. It operates moderately, and without exciting much irritation: hence it is well suited to nephritic and puerperal cases. The dose is from ʒj to ʒjfs, dissolved in any convenient vehicle. Woodville. Thomson's Lond. Disp.

SODA, in *Medicine*, a word of Arabic origin, nearly synonymous with *cardialgia*, and *heart-burn*, signifying any sense of burning heat in the stomach, arising from acidity or acrid humours. See CARDIALGIA and INDIGESTION.

The term *soda* has, however, been considered by some writers as also signifying heat and pain of the head.

SODA, in *Geography*, a town of Arabia, in the province of Nedsjed; 180 miles E. of Medina.

SODA, in *Natural History*. See KALI.

SODA *Subethica*, a term used to express a heavy and dull pain in the head.

SODADA, in *Botany*, from its Arabic name *Sodád*. Forsk. *Ægypt-Arab*. 81. Juss. 243.—A genus of the natural order of *Capparides*, which is undoubtedly distinct, and may perhaps be tolerated under the above appellation, though of avowedly barbarous origin, like *Aucuba*, and one or two similar names, of easy pronunciation. We do not, however, wish to sanction any such, but leave them to future opportunities of a thorough and authentic reform. In the present instance, at least, we attempt no amendment, because we have not materials to describe the genus under consideration. Colonel Hardwicke has brought, from the East Indies, either Forskall's identical plant, or another

species of the same genus. Forskall describes his as follows.

S. decidua. Calyx of four unequal leaves. Petals four, unequal. Stamens inclining. Capsule stalked.

A diffuse *shrub*, with distant, alternate, spreading *branches*, about two inches long, with a pair of short awl-shaped *spines* at each bud. *Leaves* sessile, oblong, deciduous, rarely present. *Flower-stalks* between the spines, single-flowered; three together. *Flowers* red. *Calyx* coloured, deciduous; its upper segment very large, gibbous, compressed, often split at the side; the rest equal, linear-lanceolate, fringed. Two upper *petals* ovate, pointed, flat, at first hidden under the upper leaf of the calyx; two lower narrower, alternate with its lower leaves, downy at the under side and edges. *Stamens* eight, unequal, thread-shaped, longer than the petals, brownish-green. *Germen* globose, with four furrows on a stalk as long as the stamens. *Style* awl-shaped. *Stigma* acute. *Fruit* red, bigger than a hazel-nut, eatable when dressed before it is ripe. This shrub is common throughout the country of Yemen.

SODALES AUGUSTALES. See AUGUSTALES.

SODALITE, in *Mineralogy*, a stone which derives its name from the large portion of mineral alkali that enters into its composition. Its colour is a blueish-green. It occurs both crystallized and massive: the crystals are dodecahedrons, with rhomboidal faces. The structure is lamellar, with joints in two directions. The fracture is conchoidal: it has a shining and resinous lustre, but the lustre of the fresh fracture is vitreous; it is translucent, and yields with difficulty to the knife. The specific gravity is 2.37. It is infusible by the blowpipe.

The constituent parts of sodalite, as given by different chemists, vary.

Silex	-	-	-	36	to	38
Alumine	-	-	-	27	to	32
Soda	-	-	-	23	to	25
Oxyd of iron	-	-	-	$\frac{1}{4}$	to	1
Lime	-	-	-	0	to	2
Muriatic acid	-	-	-	3	to	7

SODALITIUM, among the Anglo-Saxons, was the name of a voluntary association, the object of which was the personal security of those who joined in it, and which the febleness of government at the time rendered necessary. Among other regulations, which are contained in one of these still extant, the following deserves notice: If any associate shall either eat or drink with a person who has killed any member of the sodalitiun, unless in the presence of the king, the bishop, or the count, and unless he can prove that he did not know the person, let him pay a great fine. Hicks Diss. Epist. apud Thef. Ling. Septentr. vol. i. p. 21.

SODBURY, CHIPPING, anciently *Sopeberie*, in *Geography*, a small parish, containing only 90 acres, and market-town, in the lower division of the hundred of Grombald's-Ash, in the county of Gloucester, England, is situated 12 miles N. from Bristol, 30 S. from Gloucester, and 113 W. from London, at the foot of the Great Howby hill, a continuation of that chain which extends from north to south through the county. This, and the two adjoining parishes of the same name, were so called from the *berie*, or camp, which is found on the summit of Old Sodbury. Chipping distinguishes it as a market-town, and was first used when the market was established, in the reign of Henry III. The town consists of one long street, and is the great thoroughfare between Bristol and the eastern part of the county. The church consists of a nave and two aisles, with

with an embattled tower at the west end. A weekly market is held on Thursdays, and two fairs yearly. By a charter of incorporation, granted by king Charles II. in 1681, the government of the borough was vested in a mayor, six aldermen, and twelve burgesses, with a high steward, recorder, and town-clerk; and at the same time was granted the privilege of holding pleas of all manner of personal suits and debts under five pounds, arising within the borough. But in 1688, at the request of the inhabitants, from what cause is not now remembered, the charter was annulled by proclamation; and from that period the ancient government by a bailiff was revived, who is annually chosen by the lord of the manor out of three persons, returned to him at the court-leet. Two estates, called the Stub-Ridings and Meadow-Ridings, were anciently granted by two lords of the manor, in the reigns of Henry II. and John, to the bailiffs and bailiff-burgesses, for the following purposes. The former, consisting of about 100 acres, is granted for summer-pasture under certain regulations for sixty-eight cow-beasts, to as many persons as have been inhabitants of the town for fourteen years. The latter is divided into eighty-one lots, besides two others, called the Bailiff's and Hayward's piece. Each of these, containing rather more than a statute acre, is held by a lessee for his own life, and the life of his widow. Out of these estates the lord of the manor receives an annual payment of 5*l.*, and the vicar of Old Sodbury 1*l.* 13*s.* 4*d.* in lieu of tythes. The bailiff is entitled to fifty shillings yearly, for which, by ancient custom, he provides an ox and two barrels of ale, on St. Stephen's day, for the inhabitants.

A guild was founded in this borough, dedicated to St. Mary, in the reign of Henry VI., of which John Glover was the last incumbent. The lands were granted, in 1558, to the burghers of Sodbury, part for a town-hall, and part for an alms-house. A free-school is supported in this parish, by the profits of lands in different parishes. In the population returns to parliament in the year 1811, the inhabitants of this parish were stated to be 1235, occupying 236 houses. In the sanguinary reign of Mary, John Pigott was burnt here for his adherence to the Protestant religion.

The manor was granted by the Conqueror to Odo, earl of Champagne, whose grandson, William, granted the privilege of pasture-common in the Riding before mentioned, the original of which is still in existence. About the same time, William Green of Sodbury gave Gaunt's Fields to the burgesses; and Jurdan Bishop, who was lord of the manor of Little Sodbury, granted them common of pasture for cattle in Dymershed and Norwood. The manor, which by successive marriages has been possessed by various families, is now held by that of Hartley.

In the high lands, east of the town, are found a great variety of belemnites, nautilites, of the ribbed sort; and west of the town, some veins of sulphate of strontian have been discovered.

Little Sodbury is a parish adjoining Chipping Sodbury, and consists of about 900 acres of land, the greater part of which is appropriated to the dairy system. On the edge of a hill, in this parish, is a large encampment of an oblong form, comprising an area of about 200 yards from east to west, and 300 from north to south. This was probably formed by the Romans; and according to Leland, it was occupied by Edward IV.'s army, previous to the battle of Tewkesbury.

Old Sodbury is another parish adjoining the former, on the north-east, and consists of 3000 acres of land, the greater part of which is pasture.

Dodington, three miles south-east of Sodbury, is the

magnificent feat of Christopher Codrington, esq. who has long been engaged in building a spacious and splendid mansion here, from the designs of the late James Wyatt, esq. architect. Rudge's History of the County of Gloucester, 2 vols. 8vo. 1803.

SODDER, or SODER. See SOLDER.

SODDERING. See SOLDERING.

SODDING of Brick. See BRICK.

SODDOMA, IL, in *Biography*, the cognomen of Giovanni Antonio Razzi, a native of Verecelli, in Piedmont, born about the year 1479. He was instructed in painting by Giacomo dalle Fonte; but his chief object of study was the style of L. da Vinci. He was employed by Julius II. to paint the chambers of the Vatican; but the charms of Raphael's first productions in that palace were the signal for the obliteration of all other works there: among them Il Soddoma's. Other pictures, which he painted for Agostino Ghigi in the Farnesina, were more fortunate, and yet remain. Their subjects are taken from the history of Alexander the Great, and though inferior to the works of Lionardo, yet they exhibit very considerable talent, many beauties of perspective, and much playful imagery.

After he left Rome, he had considerable employment at Sienna, and there his best productions are to be found, in which he has combined the excellent qualities of the best artists of his day. He died in 1554.

SODENKYLA, in *Geography*, a town of Swedish Lapland; 110 miles N.N.E. of Tornea. N. lat. 67° 25'. E. long. 26° 14'.

SODERALA, a town of Sweden, in Helplingland; 3 miles S.W. of Soderhamn.

SODERBY, a town of Sweden, in Jamptland; 60 miles N. of Frosön.—Also, a town of Sweden, in Upland; 40 miles N.N.E. of Stockholm.

SODERHAMN, a sea-port town of Sweden, in the province of Helplingland, situated at the mouth of a river, near the gulf of Bothnia, first built by gunsmiths and copper-smiths, and erected into a town in the year 1620. The houses are mean, but the church handsome. The trade of this place is considerable in arms, linen, butter, timber, flax, &c.; 20 miles N. of Gefle.

SODERKIOPING, a town of Sweden, in the province of East Gothland. This is a staple town, situated on a navigable river, and one of the most ancient cities in Gothland. It had formerly its own municipal laws, and was in a much more flourishing condition than it is at present. Two kings were crowned, and in 1595 a diet was held in this town. It has at present but two churches; 10 miles S.S.E. of Nordkioping. N. lat. 61° 18'. E. long. 16° 54'.

SODERON, a small island near the coast of Sweden, in the Alands Haf. N. lat. 60° 15'. E. long. 8° 14'.

SODERSKARBAK, a small island in the gulf of Finland. N. lat. 60° 5'.

SODERTELGE, or *Soder Telge*, a town of Sweden, in the province of Sudermanland, situated between the sea and the Macler lake. About two miles and a half distant from this town, at a place called "Aegellstowyk," is a good harbour. Sodertelge was formerly a staple town, and in a flourishing condition; and there is still a manufacture of worsted and silk stockings in this town. In the year 1719, Sodertelge was burnt by the Russian army, but has since been rebuilt; 16 miles W.S.W. of Stockholm. N. lat. 59° 8'. E. long. 18° 28'.

SODE-SHOOTS, in *Botany*, a name given by some to the tree, whose inspissated juice is the gum tacamahacca of the shops.

SODFORS, in *Geography*, a town of Sweden, in West Bothnia; 18 miles N.W. of Umea.

SODIA, a town of Arabia, in the province of Hedsjas; 70 miles S.S.E. of Mecca.—Also, a mountain of Arabia, in the province of Hedsjas; 60 miles S. of Mecca.

SODINUS, in *Ancient Geography*, a navigable river of Asia, which runs into the Cophes, according to Pliny.

SODIUM, in *Chemistry*, a simple body and a metal. This was discovered by sir Humphrey Davy in the year 1807. He had a few days before found that potash was a compound of a peculiar metal combined with oxygen, and he now found that soda consisted of a metallic substance combined with oxygen. He first produced it by exposing soda to the action of the Galvanic battery.

It is now obtained by fusing soda or muriate of soda with potassium. The potassium combines with the oxygen in the soda, and with the chlorine in the salt, leaving pure sodium.

This metal is white, resembling silver; and having the same metallic lustre.

Its specific gravity is between 9 and 10, water being 1. In the common temperature it is malleable.

It assumes the liquid form at 200° of Fahrenheit, and is volatile at a red heat.

If exposed to the air it would soon lose its lustre, by combining with oxygen, and in a little time would be converted into soda.

It is preserved in naphtha, like potassium.

When heated in oxygen or chlorine, it burns with great brilliancy.

When thrown upon water, it does not sink but runs along the surface, the motion being occasioned by the rapid escape of hydrogen gas, from its decomposing the water with great rapidity. The floating mass is seen to diminish as it runs along, till it disappears, when, as may be expected, the water is found to contain a solution of soda.

Sodium, like other metals, is a conductor of electricity.

Sodium combines with two doses of oxygen. The one is that which constitutes soda; the other is of an orange colour, first observed by sir Humphrey Davy; but for the particulars of its nature we are indebted to M. M. Gay Lussac and Thenard.

Soda, in its pure state, is a solid of a greyish-white colour, very hard, and breaks with a smooth fracture. In this state it requires a strong heat for its fusion. When exposed a little to the air, it absorbs water, assumes a whiter colour, and becomes much more fusible by heat. Its volatility is also increased at the same time. In this state, as is the case with lime, potash, and many of the metallic oxyds, it is called an hydrate.

The peroxyd of sodium is formed by burning sodium in oxygen gas, an excess of the gas being present.

It is of a deep orange colour, and fuses at a much less heat than soda.

If thrown into water, one atom of oxygen escapes in the form of gas, leaving pure soda, which dissolves in the water. This proves how closely the excess of oxygen is held. This, however, is more conspicuously shewn in its action upon combustible bodies, with which it desagrates.

The atom of sodium has been considered 22; hydrogen being 1, and oxygen 7.5; hence the protoxyd would be 29.5, and the peroxyd 37. But from the experiments of Gay Lussac and Thenard, it appears that the oxygen in the soda is to that in the peroxyd as 1 to 1½, or as 2 to 3; but as the existence of half atoms would be absurd, the atom of sodium must be considered as equal to 44; the protoxyd will then be 51.5; the deutoxyd, which is soda, will

be $44 + 2 \times 7.5 = 59$, and the peroxyd $44 + 3 \times 7.5 = 81.5$.

Soda combines with sulphur, and is called sulphuret of soda. It possesses properties differing but little from the sulphuret of potash. It is formed by fusing sulphate of soda with common saw-dust. Like sulphuret of potash, when thrown into water, it first dissolves, and decomposing that fluid, the remaining sulphuret combines with the hydrogen in its nascent state to form hydrogen with sulphuret of soda. This forms a greenish-coloured fluid, having the smell of sulphuretted hydrogen. The phosphuret of soda is also similar to the phosphuret of potash. See POTASH.

Sodium also combines with sulphur and phosphorus. When sodium and sulphur are heated together in a vessel filled with vapour of naphtha, they unite with all the signs of splendid combustion, the sulphur supplying the place of oxygen. The compound is of a grey colour, producing sulphate of potash by exposure to the air. Their proportions ought to be 44 sodium to 15 sulphur for the first, and 44 to 30 for the second sulphuret.

Sodium has a similar effect upon phosphorus, by which the phosphuret of sodium is produced. It has no known action upon carbon, azote, or hydrogen.

Sodium combines with many of the metals, forming peculiar alloys. With potassium, in a small proportion, it forms an alloy, which, agreeably to other alloys, is more fusible than either of the metals. The alloy is of less specific gravity than either of the metals, a circumstance not common with other metallic alloys. The latter fact goes to prove that there is not a great affinity between the two metals.

One part of sodium renders 40 of mercury solid, at the common temperature. When they combine, heat is disengaged. It also combines with tin, without changing its colour. When these alloys are exposed to the air, the sodium is gradually separated, by combining with the oxygen of the atmosphere.

Salts of Soda, or its Compounds with the Acids.—Under this head we shall comprise the muriate of soda, although, in strict propriety, we might have been expected to have treated this compound under the action of sodium upon chlorine.

Sulphate of Soda.—This salt is found native in most sea-vegetables; it has been called Glauber salt. It may be easily formed by adding sulphuric acid to the crystallized carbonate of soda, till the effervescence ceases, and the solution is neither acid nor alkaline.

On evaporation and cooling, it easily crystallizes into six-sided prisms of a pearly appearance. Their taste is cooling and rather bitter. At the temperature of 60° it dissolves in less than three times its own weight of water, and in much less than its own weight of boiling water. When a solution of this salt is concentrated till it has something less than half its own weight of water, and carefully set by to cool, it will not crystallize; but if a tremulous motion be given to the vessel, or a crystal of the same salt dropped into it, the whole suddenly crystallizes, exhibiting a beautiful appearance. When the crystals are exposed to the air, they lose their water of crystallization, and assume the form of white powder. In this change they lose about 60 per cent. of their weight, as will be seen in their analyses.

According to Kirwan, it is composed of

Sulphuric acid	-	-	23.52
Soda	-	-	18.48
Water	-	-	58.
			<hr/>
			100
			<hr/>

SODIUM.

According to Bergman,

Acid	-	-	27
Soda	-	-	15
Water	-	-	58
			100

Wenzel's analysis of the dry salt is,

Acid	-	-	55.7
Soda	-	-	44.3
			100

Kirwan's analysis of ditto,

Acid	-	-	56
Soda	-	-	44
			100

It appears that this salt consists of two atoms of acid to one of soda, and 20 atoms of water. This, if hydrogen be 1, will be 37.5×2 acid + 59 soda + 170 water = 304. Reduced to the hundred, it will be

Acid	-	-	19.4
Soda	-	-	24.6
Water	-	-	56.
			100

Nitrate of Soda.—This salt has been called *cubic nitre*, from having the general properties of nitrate of potash, but differing in the form of its crystals, which are of a cubical, or rather rhomboidal form.

It may be formed by saturating pure carbonate of soda with nitric acid.

On evaporation and cooling, it forms rhomboidal crystals, the specific gravity of which is 2.0964, water being 1.

These crystals dissolve in three times their weight of water at 60°, and in less than their own weight of boiling water.

With inflammable bodies and heat, it exhibits phenomena similar to those of nitre: but it is inferior to that substance in forming gunpowder with charcoal and sulphur.

Its proportions, according to Bergman, are

Nitric acid	-	-	43
Soda	-	-	32
Water	-	-	25
			100

According to Kirwan, in the dry state,

Nitric acid	-	-	57.55
Soda	-	-	42.34
			99.89

This salt appears to be composed of one atom of acid and one of soda, in the dry state, or 50.5 acid and 44 soda = 94.5. This will give

Nitric acid	-	-	53.5
Soda	-	-	46.5
			100

Muriate of Soda.—This salt, which is the common culinary salt in a state of purity, is a component part of almost all animal matter; nor is there perhaps a vegetable that does not yield some portion of it.

It exists ready formed in the sea, and forms entire mountains in the substance of the globe. It is from the native salt that all the muriatic acid is obtained. It is never formed by art, but the pure salt may be obtained by adding carbonate of soda to the salt in solution; then evaporate it to obtain crystals; these are of a cubic form, and pure muriate of soda.

According to the prevailing view now taken of this salt, it is a compound of sodium and chlorine, or what was called oxymuriatic acid. Hence it is not considered as a salt, those bodies being compounds of an acid and an oxyd. The substance in question is believed to be a compound of sodium, an inflammable body, combined with another body, having more the properties of oxygen than any other body. Muriate of soda is, therefore, considered as being more allied to an oxyd than a compound of two, the chlorine acting the part of oxygen. It is called by Sir Humphrey Davy *sodane*, by Dr. Thomson *chloride of sodium*, and by the French chemists *chlorure of sodium*. The taste of this salt may be called the standard of that sensation we call *salt*. Its specific gravity is 2.12; it is soluble in about three times its weight of water at 60°, and nearly in the same quantity of boiling water.

It is unchanged by exposure to the air. The moist state in which it is frequently found in commerce, arises from the presence of a little muriate of lime, which the purest native salt always contains; but it is more abundant in the salt obtained from sea-water.

It is composed, according to Bergman, of

Muriatic acid	-	-	52
Soda	-	-	42
Water	-	-	6
			100

According to Kirwan, when dried at 80°,

Acid	-	-	38.88
Soda	-	-	53.
Water	-	-	8.12
			100

Sir Humphrey Davy considers it a compound of 2 atoms of chlorine and 1 of sodium, or 2×33 chlorine + 44 sodium = 110. This will be

Chlorine	-	-	60
Sodium	-	-	40
			100

See the article *SALT*.

Phosphate of Soda.—This salt has been longer known than phosphorus. It exists ready formed in urine, from which it was extracted, and called *sal mirabile perlatum*, or wonderful perlated salt. It was so called from its crystals having a pearly appearance. This salt, with excess of acid, was considered by Proust as a peculiar acid, which he called the perlated acid. But it was ultimately found by Klaproth, and afterwards by Schiele, to be a compound of soda with the phosphoric acid.

SODIUM.

Dr. Pearson first prepared it artificially, and introduced it into medicine as a purgative. He dissolved 1400 grains of crystallized carbonate of soda in 2100 grains of water, and added gradually 500 grains of phosphoric acid, of the specific gravity 1.85. This solution he boiled for a few minutes, and filtered it while hot. The solution was set out in a cool place to crystallize.

This salt is often made by saturating soda with the superphosphate of lime obtained from bones by sulphuric acid, and is never sufficiently free from lime.

The acid should be obtained by burning phosphorus, and the soda used in the state of well-formed crystals, when the pure salt is required.

It crystallizes in the form of rhomboidal prisms, terminating with three-sided pyramids.

It effloresces by exposure to the air.

Its taste is very like muriate of soda, but more mild and agreeable.

It is soluble in four parts of cold, and in about three parts of boiling water.

When exposed to heat it first undergoes the watery fusion. When heated to redness, it melts into a white enamel. From this property it has been proposed as a substitute for borax, in the soldering of metals: it also resembles the same substance in forming coloured glasses with metallic oxys.

It is partially decomposed by the sulphuric, nitric, and muriatic acids, leaving it in a state containing double its original quantity of acid. This is called the superphosphate of soda. It was this salt which Proust took for a peculiar acid. It is more soluble in water than the phosphate, and does not easily crystallize.

Phosphate of soda has not been analysed: since, however, the weight of an atom of phosphorus is 13, and phosphoric acid $13 + 2 \times 7.5 = 28$, then phosphate of soda will be $2 \times 28 + 59$, or

Soda	-	-	-	-	51
Acid	-	-	-	-	49
					—
					100
					—

Fluate of Soda.—This salt may be formed by adding fluoric acid to carbonate of soda, till the effervescence ceases.

On evaporation, it forms into cubic crystals. These are sparingly soluble in water, and have an astringent bitter taste.

Borate of Soda.—This is a salt with half the quantity of acid which the borate contains; it is known in commerce and in the arts by the name of borax. The latter substance is extracted from a substance called tincal: the true borate is, therefore, not used, but the sub-borate or borax.

Sub-borate of soda is crystallized in hexagonal prisms, with two sides broader than the rest. It is semitransparent. Its specific gravity is 1.74. It is soluble in twelve parts of cold water, and in six of boiling water. It has a sweetish taste, and rather alkaline. When exposed to the air, it is soon reduced to a white powder, with much loss of weight. This arises from the escape of the water of crystallization. Artists are apt to use it too plentifully in this state, and fancy that its proper virtue is gone; but the white powder is equally valuable with the salt for all purposes. When the same change is brought about by heat, the borax is said to be calcined. If a strong heat be given to it in a crucible, it melts into a transparent glass. It is frequently used in forming choice specimens of sham crystals, by fusion

with flint, lead, and manganese. The composition of borax, according to Bergman, is,

Acid	-	-	-	39
Soda	-	-	-	17
Water	-	-	-	44
				—
				100
				—

The acid is obtained from this salt by dissolving it in hot water, and then adding sulphuric acid. As the liquid cools, small scaly crystals are precipitated, which are the pure boracic acid.

The base of this acid has been discovered since the commencement of this work, and even since this acid has been treated of: we, therefore, feel it our duty to give some account of it here.

When boracic acid, slightly moistened, is exposed between two plates of platina, one being connected with the copper side of a Galvanic battery, and the other with the zinc side, the oxygen of the acid is attracted to the zinc or positive side, and the inflammable base to the copper or negative side. This is a dark coloured substance, which becomes detached from the rest of the mass, and is the base in question. This experiment was first made by sir Humphrey Davy, in March 1808, about the time that he discovered potassium and sodium. In the November following it appears that he, as well as Messrs. Gay Lussac and Thenard, obtained this base by heating boracic acid with potassium. The latter chemist also succeeded in recomposing the acid. This substance has been called *boron* by sir Humphrey Davy, which name it still retains.

Boron is an opaque substance of a dark olive colour.

It is not fusible or volatile at any known temperature. When heated in the open air, it burns by absorbing oxygen, and is converted into dry boracic acid. In pure oxygen gas it undergoes more vivid combustion, giving out bright scintillations. The mass becomes coated with boracic acid, and the remainder of the base is found unchanged in the crust.

It is a non-conductor of electricity, a proof that it is not of a metallic nature.

It is insoluble in water.

The proportion of oxygen in boracic acid is not yet known. The crust of boracic acid, which forms on boron when it is burned, secures the remainder from the oxygen, so as to render the result ambiguous.

Sir Humphrey Davy judges, from the quantity of potassium required for the decomposition of the acid, that it contains two-thirds its weight of oxygen. Gay Lussac and Thenard, from treating boron with nitric acid, make it to contain one-third its weight of oxygen; but this result is not to be relied upon, since boracic acid is volatile both with water and the nitric acid.

Sir Humphrey Davy found that 90 parts of potash were required to neutralize 160 of boracic acid. This will give 80 for the weight of the atom of boracic acid, potash being 45, and hydrogen 1. If, according to sir Humphrey, it contains two-thirds of oxygen, then the atom of boron will be 27.

Dr. Thomson, from the experiments of Berzelius, which are in some measure corroborated by those of sir Humphrey Davy, makes the atom of boron 5.5, hydrogen being 1. This is the weight of the atom of carbon, to which boron seems in other respects allied. If, like carbon, it combines with two atoms of oxygen, then boracic acid will be

$5.5 + 7.5 \times 2 = 20.5$. Sir Humphrey's atom, which is 80, is nearly a multiple of this number.

Carbonate of Soda.—This is the salt known by the name of sal foda. It exists ready formed in barilla and kelp, and is easily obtained by solution and evaporation, allowing it to crystallize slowly. It crystallizes in flat rhomboidal prisms. It is soluble in two parts of cold water, and in less than its own weight of boiling water. Like the sulphate of soda, it effloresces in the air, and assumes the form of white powder.

When heated, it melts in its own water of crystallization. This soon escapes; and if the heat be raised, one half of the carbonic acid probably escapes.

According to Bergman, its composition is,

Soda	-	-	-	20
Acid	-	-	-	16
Water	-	-	-	64
				100

According to Klaproth, it contains,

Soda	-	-	-	22
Acid	-	-	-	16
Water	-	-	-	62
				100

According to Kirwan, in crystals,

Soda	-	-	-	21.58
Acid	-	-	-	14.42
Water	-	-	-	64
				100

In the dry state,

Soda	-	-	-	59.86
Acid	-	-	-	40.14
				100

This salt is composed of 2 atoms of acid, 1 of foda, and 20 of water; or 41 acid, 59 foda, and 170 water. This, in 100, will be,

Soda	-	-	-	21.8
Acid	-	-	-	15.2
Water	-	-	-	63
				100

This salt, although called a carbonate, is evidently a bicarbonate of soda; and the salt, which results from heating this, must be considered a carbonate.

There is another compound, with a still greater proportion of carbonic acid, which is either a tricarbonate or a tetracarbonate of soda.

Arseniate of Soda.—This is a salt little known, but believed to have the general properties of arseniate of potash. See that salt under SALTS.

Acetate of Soda.—This salt may be formed by saturating carbonate of soda with acetic acid. It crystallizes in prisms resembling sulphate of soda. It is soluble in about three parts of water at 60°. It does not crystallize but with excess of alkali.

The other salts of soda are too little known to be important.

SODMERE POINT, in *Geography*, a cape on the S. coast of the Isle of Wight. N. lat. $50^{\circ} 38'$. W. long. $1^{\circ} 16'$.

SODOM, in *Ancient Geography*, the chief city of the Pentapolis, which comprehended the five cities called Sodom, Gomorrah, Zeboim, Admah, and Zoar or Segor. The four former were destroyed on account of their wickedness by fire from heaven, A.M. 2107 or B.C. 1897; but the latter, though sentenced to the same fate, was spared at the intercession of Lot. Sodom had been his dwelling-place, and the plain on which Sodom and the other cities stood was pleasant and fruitful, like an earthly paradise, but after their destruction it was overflowed by the waters of the river Jordan, which thus formed the "Dead sea," or "lake of Sodom," or the "ASPHALTITE Lake," which see. A French geographer, setting aside the miraculous part of this event, ascribes it to a volcanic eruption, and he conceives the lake to have been the crater of the volcano; but it is sufficient to observe that this opinion contradicts the historical narration of this event.

In the time of Josephus the ruins of these cities were still in being. Strabo (Geog. l. xv.) also speaks of the ruins of Sodom, which were 60 furlongs in compass, and were visible on the shore of the Dead sea. The "Notitia" expressly mentions Sodom as an episcopal city: and we find one Severus, a bishop of Sodom, among the bishops of Arabia who subscribed to the first council of Nice. Reland, however, cannot allow that Sodom was ever rebuilt, and he thinks that the word Sodom, among the subscriptions to the council of Nice, to have been an error of the copiers. Calmet is of a different opinion. The record, he says, is very circumstantial: it puts the episcopal city of Sodom between Thamar and En-geddi. Stephanus, the geographer, places En-geddi near Sodom. Hence Calmet concludes, that the city of Sodom was rebuilt, either in or near its former situation; for though it appears probable that it was not covered by the waters of the Dead sea, and that it stood on the shore of this sea, yet, says Calmet, "I would not strenuously oppose the contrary opinion."

SODOMY, the unnatural crime of buggery; thus called from the city of Sodom, which was destroyed by fire for the same. This is usually, and very justly, denominated the "crime against nature," when committed with man or beast:—a crime, which ought to be strictly and impartially proved, and then as strictly and impartially punished. The delicacy of our English law treats it, in its very indictments, as a crime not fit to be named; "peccatum illud horribile, inter Christianos non nominandum." The edict of Constantius and Constantine observes a similar taciturnity; "ubi scelus est id, quod non proficit scire, jubemus infringere leges, armari jura gladio ultore, ut exquisitis poenis subdentur infames, qui sunt, vel qui futuri sunt rei."

The Levitical laws adjudged those guilty of this execrable evil to death, Lev. xviii. 22, 23. xx. 15, 16; and the civil law assigns the same punishment to it. Our ancient law commanded such miscreants to be burnt to death (Brit. c. 9.), though Fleta says (l. i. c. 37.) they should be buried alive; either of which punishments was indifferently used for this crime among the ancient Goths. At present our laws make it felony. (25 Hen. VIII. c. 6. 5 Eliz. c. 17.) And the rule of the law is, that if both are arrived at years of discretion, "agentes et consentientes pari poena plectantur." 3 Infl. 59.

SODRA BARKER, in *Geography*, a town of Sweden, in Dalecarlia; 40 miles S. of Fahlun.

SODRES, in *Ancient Geography*, a people of India, in the number of those who were subdued by Alexander, according to Quintus Curtius, l. viii.

SODUCENA, a country of Asia, in the Greater Armenia, S. of Colthene, according to Ptolemy.

SODUS, GREAT, in *Geography*, a large township of America, in the N.E. corner of Ontario county, in the state of New York, with a post-office called "Troupville," bounded N. by lake Ontario, E. by Seneca county, S. by Lyons, and W. by Williamfon and Palmyra; about 18 miles square, and including a great part of Sodus bay. The surface is undulated with hillocks and vallies, in a N. and S. direction, and the soil is good and well watered. The timber is luxuriant, and consists of the fugar-maple, beech, oak, hickory, elm, ash, linden or bass-wood, cherry, tulip-tree or poplar, butternut, &c. Crops of wheat, rye, maize, hemp, flax, oats, and the common grasses, succeed well, as do also the common fruits of the country. In the N.E. corner of Sodus is Great Sodus bay, reckoned the best harbour on the S. shore of the Ontario; and on an elevated point of land, projecting into the bay, the post-village of Troupville is very eligibly and handsomely situated, 212 miles from Albany, and about 30 N.E. of Canandaigua. Sodus has two grist-mills, five saw-mills, one fulling-mill, and a considerable number of the common mechanical branches of manufacture for the convenience of the inhabitants. Here are two meeting-houses, one for Presbyterians and one for Baptists, and several school-houses. Iron ore has been found here. The first settlements in this town commenced in 1790, by two German families from the Mohawk river; and though the progress of population was slow, it amounted, by the census of 1810, to 1957 persons, and 343 families. N. lat. $43^{\circ} 10'$. W. long. $77^{\circ} 5'$.

Sonus, *Little*, a town of New York, in Albany, on the S. side of lake Ontario; 12 miles E. of Great Sodus.

SOEBORG, a town of Denmark, in the isle of Zealand, seated on an island in a fresh-water lake. Near this town is a triangular pillar, with Latin, Danish, and German inscriptions, erected in the year 1738, in honour of Frederick IV. and Christian VI., for having stopped the progress of flying sand, which overwhelmed one tract of land and village after another, and threatened the best part of Zealand with desolation. In the reigns of these two monarchs this evil was restrained under the inspection of the prefect Frederick Von Gram, by the address of John Ubr. Rohl. This sandy waste is now covered with verdure, and appears like a fine meadow; 9 miles W.N.W. of Helsingoer.

SOELBO, a town of Norway, in the province of Drontheim; 20 miles E. of Drontheim.—Also, a lake, 18 miles S.E. of Drontheim.

SOELENGAT, a town of Norway, in the province of Bergen; 112 miles N. of Bergen.

SOEST, or **ZOEST, GERARD**, in *Biography*, was a native of Westphalia, born about the year 1637. He acquired the art of painting in his own country, but practised principally in this, whither he came rather before the period of the restoration. His portraits have a considerable portion of truth and animation, wrought in a finished manner, and with great warmth and glow of colour; so much so as to class him among the better rivals of sir Peter Lely. He was most successful in his portraits of men, among whom he had a very considerable share of employment; but the more graceful and engaging pencil of sir Peter secured the charms of the softer sex to himself. Soest died at the early age of 44.

SOEST, in *Geography*, a town of Germany, in the county of Mark, formerly one of the Hanse towns, enjoying imperial privileges and the right of coining money. Its extent is large, and contains several churches. It was the place in which several of the successors of Charlemagne resided; 22 miles E. of Dortmund. N. lat. $51^{\circ} 33'$. E.

long. $8^{\circ} 11'$.—Also, a river of East Friesland, formed by the union of the Solte and Vehne, which, after a straight course, runs into the Leer near Stikhufen.

SOETA, in *Ancient Geography*, a town of Scythia, beyond the Imaus. Ptolemy.

SOETERWEER, in *Geography*, a town of Holland; 8 miles E. of the Hague.

SOFA, in the East, a kind of alcove raised half a foot above the floor of a chamber, or other apartment; and used as the place of state, where visitors of distinction are received.

Among the Turks, the whole floor of their state-room is covered with a kind of tapestry, and on the window-side is raised a sofa or fopha, laid with a kind of matras, covered with a carpet much richer than the other. On this carpet the Turks are seated, both men and women, like the taylor in England, cross-legged, leaning against the wall, which is bolstered with velvet, fatten, or other stuff, suitable to the season. Here they eat their meals; only laying a skin over the carpet, to serve as a table-cloth, and a round wooden board over all, covered with plates, &c.

The ambassadors of France stood out a long while, and refused to visit the grand vizir, unless he would receive them on the sofa: at length he granted them the sofa.

SOFALA, ZOFALA, or *Quitere*, in *Geography*, a kingdom of Africa, bounded on the N. and W. by the states of Mocaranga, on the E. by the Mozambique channel, and on the S. by Sabia, about 350 miles from E. to W. and 120 from N. to S., extending about 50 leagues along the coast and about 80 into the interior of the country. This country is said to be subject to a Mahometan prince, tributary to the king of Portugal. Its capital, of the same name, was, at the arrival of the Portuguese, an inconsiderable town, without walls, and fenced only with a thorny hedge; but it has since been fortified, and much improved, as well as the fort, which they constructed for its defence. It was then called "Cuama;" but geographers and pilots retain its ancient name of Sofala. It is conveniently situated on a small island, at the mouth of the river Cuama. On the coast are also two other towns, *viz.* Haulema and Dardema, with several obscure villages. The natives of Sofala are generally black, with short curled hair; in shape taller and more genteel than the negroes of Mozambique, Quiloa, &c. Their common dress is a piece of silk or cotton, wrapped round the middle, covering them to the knees; the rest of the body being naked, except the head, as persons of the superior class wear a kind of turban. All persons adorn their necks, arms, wrists, legs, and ancles, with rings of gold, silver, amber, or coloured beads, according to their condition. The stuffs and trinkets used in their dress are chiefly imported from Bombay by the Portuguese; and those of the better sort affect to wear swords with handles of ivory. The inhabitants of the country and town of Sofala are a mixture of Mahometan Arabs, idolatrous Caffres, and Portuguese Christians. Those who inhabit the coast speak the Arabic tongue, which is their native language; as they are not the original natives but the descendants of the Arabs, who, leaving their native country, settled more or less on this coast. They cultivate rice and millet for bread, and eat the flesh of elephants, large and small cattle, and also fish, with great variety of which the sea and rivers abound. They likewise make beer both of rice and millet, and some other liquors from honey, palm, and other fruits. Honey is abundant, and bees-wax serves them to exchange for painted cotton or silk, and other cloths. Their principal commerce is carried on with the inhabitants of Mozambique, Quiloa, Mombaça, and Meluda,

linda, who come hither in their "zambucks," or small barges, which are freighted with a variety of the fore-mentioned cloths of all colours, exchanging them for gold, ivory, wax, or ambergris, and also with the Portuguese. The Arabians exchange goods from the East Indies and the Red sea, to the amount of 140,000*l.* sterling annually for ivory and gold. Besides the gold which is brought from Mocaranga, Sofala has some very considerable mines of that metal, which, according to the reports of the Portuguese inhabitants, have yielded to the value of above two millions of merigals yearly, each merigal being valued at about fourteen French livres, amounting, according to Mr. Savary's statement, to 1,166,666*l.* sterling. The sands also of the river Sofala contain a very considerable mixture of gold-dust. Some persons have even affirmed that Solomon obtained his gold, which is so highly commended by the sacred historians, from this country, and that Sofala is the celebrated Ophir; the gold being allowed to be the purest and finest in all Africa. (See OPHIR.) The Mahometan religion is said by many writers to be that of the king and court, and of a great part of the people; but others think it more probable, that the original natives are wholly destitute of any religion; and that the Arabians, who have settled on this coast, are the only Mahometans, except some few profelytes, from the Negroes, who became such for the sake of commerce; as they observe, that all the merchants who came hither from Quiloa, Mombaça, and Melinda, are of that religion. S. lat. 19° to 22°. E. long. 33° to 36°.

SOFALA, a town of Africa, in the country of the same name. S. lat. 19° 22'. E. long. 36°. See the preceding article.—Also, a river of Africa, which rises in the country of Mocaranga, and pursuing an easterly course, runs into the sea, S. lat. 19° 22'.

SOFEE. See SOPHI.

SOFFIETTA, in *Ichthyology*, the bellows-fish, a name by which some have called the scolopax, a small sea-fish, common in the markets of Rome and Venice.

SOFFINGERBA, in *Geography*, a town of Italy, in Friuli; 4 miles N.N.W. of Friuli.

SOFFITA, SOFFIT, or *Sofit*, in *Architecture*, any timber ceiling, formed of cross-beams, or flying corniches; the square compartments or pannels of which are enriched with sculpture, painting, or gilding.

The word is Italian, and signifies the same with the Latin *lacunar* and *laquear*; with this difference, that *lacunar* is used for any ceiling with square, hollow pannels, called *lacus*; and *laquear* for compartments interlaced with plat-bands, after the manner of knots or *laquei*.

Such are those we see in the basilics and palaces of Italy, in the apartments of Luxembourg, at Paris, &c.

SOFFITA, or *Soffit*, is also used for the under side or face of an architrave; and more particularly for that of the corona or larmier, which the ancients called *lacunar*, the French *plafond*, and we usually the *drip*.

It is enriched with compartments of roses; and in the Doric order has eighteen drops, disposed in three ranks, six in each, placed to the right of the guttæ, at the bottom of the triglyphs.

SOFI, or SOPHI. See SOPHI.

SOFIA, in *Geography*. See SOPHIA.

SOFIANA, a town of Persia, in Adirbeitzan; 25 miles S.W. of Tabris.

SOFIT, or SOFFIT, the internal superficies of an arch; sometimes it signifies the opening itself.

SOFR, in *Geography*, a town of Arabia, in the province of Hedsjas; 70 miles S.E. of Mecca.

SOFRA, a town of Arabia, in the province of Nedsjed; 50 miles N.E. of Kariatain.

SOFREGAM, a town of the island of Ceylon; 54 miles S. of Candi.

SOFROI, a town of Fez, in the province of Chaus, trading principally in oil; 12 miles E. of Fez.

SOFT CHALK, in *Agriculture*, a sort of fossile marle, which readily moulders down and becomes blended with the mould of the soil, on which account it forms an excellent manure, free from the objection made to that of the hard kind, which mostly requires to be reduced into lime. This sort of substance is often met with at some depth at the bottoms of chalk hills, where search should be constantly made for it, as it may become of great value as manure. All soft mouldering chalks are not only excellent substances for applying on lands that are of the stiffish kinds, but they commonly form good soils, where they are the principal material.

SOFT Grass, a troublesome sort of grass among moist arable lands in some places. See HOLCUS.

SOFT Meadow-Grass, the common name of a common grass in moist meadows, but which is of no great value for the purposes of the farmer. There is also a creeping soft grass often met with, which is said to be useful on dry sandy soils in producing a turf or sward. See HOLCUS.

SOFT Pulse, Roe, and Soap. See the substantives.

SOFTENING, in *Painting*, the mixing and diluting of colours with the brush or pencil.

To soften designs in black and white, made with the pen, &c. signifies to weaken the teint.

To soften a portrait, according to Felibien, is to change some of the strokes, and give a greater degree of sweetness and softness to the air of it, which before had something rough and harsh in it.

SOGANA, in *Ancient Geography*, a town of Judea, in the half tribe of Manasseh, on the other side of Jordan. It was fortified by Josephus, when he was governor of Galilee.

SOGANLIK, in *Geography*, a town of European Turkey, in Bulgaria, on the Black sea; 8 miles E. of Varna.

SOGD, the most celebrated and fertile district of Great Bucharia, being the ancient *Sogdiana*, which see. See BUCHARIA.—Also, a river which pervades this district, and which, at the distance of 100 miles from Samarcand, situated on its southern bank, after washing the walls of Bokhara, passes through a considerable lake, and is supposed to join the Oxus or Amu.

SOGDI, in *Ancient Geography*, a people of India, on this side of the Ganges, according to Quintus Curtius, who places them on the left bank of the river Indus. The same historian informs us that Alexander built a city in the country of these people, and called it Alexandria. He also relates, that when some of these people, who resided not far from the country of Odin's Goths, were condemned to death by Alexander on account of a revolt, they rejoiced greatly, and testified their joy by singing verses and dancing. When the king inquired the reason of their joy, they answered, that "being soon to be restored to their ancestors by so great a conqueror, they could not help celebrating so honourable a death, which was the wish of all brave men, in their own accustomed songs." This correspondence of manners and principles between the Scandinavians and the Sogdians furnishes a striking proof of Odin's migration from the E. to the N.; first, in the spontaneous exercise of the poetical talent; and, secondly, in the opinion, that a glorious or warlike death, which admitted them to the company of their friends

and parents in another world, was to be embraced with the most eager alacrity, and the highest sensations of pleasure. This is the doctrine of the "Edda." Warton's *Hist. of Eng. Poetry*, Diff. 1.

SOGDIANA, a country of Asia, between the rivers Jaxartes and Oxus, towards the N.E. of the territories known to the ancients. See **BOKHARA**, **BUCHARIA**, **MAWARUL-NERE**, and **SOGD**.

SOGDIANA Petra, a fortress of Asia, in Sogdiana, situated on a craggy rock. Alexander besieged and took it, and there found Roxana, the daughter of Oxiartes, according to Arrian.

SOGERVI, in *Geography*, a town of Nubia, on the E. side of the Nile; 20 miles W. of Ibrim.

SOGESTA, a town of Sweden, in East Gothland; 6 miles N.N.W. of Linköping.

SOGENDAAL, a town of Norway; 32 miles S. of Stavanger.

SOGETTO, Ital., *subject*, an initial theme or text, in *Music*, for a composer to work into a movement for voices or instruments, without any limitation of parts in its accompaniment.

A subject is frequently given by a master to a student in counterpoint, in the bass, the tenor, or the treble, for him to write upon, or find accompaniments to in every station, alternately; which, when happily achieved, becomes double counterpoint. Writing upon *canto fermo*, as is constantly done by the students in the conservatorios at Naples, for several years, before they are allowed to set words or exercise their fancy in instrumental compositions, is of this kind. Candidates for organists' places, and other professional appointments and honours, have subjects of fugue frequently given them at elections, to play upon extempore; which, if the judges are profound and severe, is a trial of abilities and courage, in which few are able to acquit themselves to their satisfaction. See **FUGUE**, **CANTO FERMO**, **DOUBLE COUNTERPOINT**, and **ROSEINGRAVE**.

SOGLAH, in *Geography*, a town of Asiatic Turkey, in the province of Caramania; 42 miles S. of Cogni.

SOGLIO di Bari, an island near the coast of Naples, in the gulf of Tarento; 11 miles W. of Alessano.

SOGNE, a town of Norway, in the province of Christiania, near Christiania.

SOGNE Bay, a wide river of Norway, 40 miles long, and about two broad, which runs into the North sea, N. lat. 61° 2'. E. long. 5° 20'.

SOGNO, **SONGO**, or **Sonbo**, a province of Africa, in the kingdom of Congo, on the S. side of the Zaire, along the coast of the Atlantic: its chief articles of trade are slaves and elephants' teeth: the inhabitants generally profess themselves to be Christians.—Also, a town of Africa, the capital of the above-mentioned province. It is a large straggling town, consisting of about 400 houses, situated on a creek or small river, about a mile from the Zaire. The houses are in general thatched, and the sides or walls, (if they may be so called,) composed of palm-branches, interwoven with leaves. The English factory, that formerly subsisted in this place, has been long since abandoned.

SOGOCARA, in *Ancient Geography*, a town of Asia, in the Greater Armenia. Ptolemy.

SOGONI, in *Geography*, a town of Nubia, on the Nile; 115 miles S. of Syene.

SCHACZOW, a town of the duchy of Warfaw; 38 miles E.N.E. of Lancicz.

SOHAGEPOUR, a circar of Hindoostan, in Allahabad, bounded on the N. by Boggileund and Chandail, on the E. by Singrowla and Chohan, on the S. by Gurry

Mundella, and on the W. by Gurrah.—Also, a town of Hindoostan, and capital of the above-named district; 120 miles S. of Allahabad. N. lat. 23° 30'. E. long. 81° 54'.

SOHAIG, a town of Egypt, on the W. side of the Nile; 3 miles N. of Achmim.

SOHAL, a town of Arabia, in the province of Oman; 72 miles S.W. of Mascat.

SOHAM, formerly *Seham*, a town in the hundred of Staplehoe, and county of Cambridge, England, is situated on the borders of that county, adjoining Suffolk, at the distance of 5 miles S.E. of Ely, and 7 N. of Newmarket. Here was formerly a market on Thursdays, but it has been discontinued about a century. Two annual fairs are, however, still held here. During the Anglo-Saxon dynasty, Soham appears to have been a place of some consequence, and according to Leland ("Collectanea," vol. ii. p. 247.) was the seat of the East Anglian bishops. The same author states, that Felix, the first bishop, was buried at this place, and that his body was afterwards removed to Ramsey. The bishop's palace and the church were destroyed by the Danes in 870. Some remains of ancient buildings are now visible. Part of this parish was formerly occupied by a large mere or lake, which covered about 1369 acres, but the water has been drained off, and the land appropriated to tillage. On the division of the commons of Soham, in 1685, Sir Thomas Chicheley, then lord of the manor, and the other landholders, allotted 116 acres of moor or fen-land for the benefit of the poor. A school was then founded, and a schoolmaster now receives 50*l.* a-year for superintending the poor children of the parish. Three alms-houses were founded here in 1502 by Richard Bond; and in 1581, nine others for widows were founded by Thomas Pechey. Lysons's *Magna Britannia*, Cambridgeshire, vol. ii. part i. 4to. 1808.

SOHAR, a town of Arabia, in the province of Oman, formerly a place of great splendour, but now of little or no importance; 44 miles N.W. of Mascat. N. lat. 24° 17'.

SOHAUL, a town of Hindoostan, in the circar of Boggileund; 30 miles W. of Rewah.

SOHAUN, one of the smaller rivers of the Panjab, in Hindoostan, which takes its course between the Behut and Sinda, and runs into the latter about 60 miles S. of Attock.

SOHDA, a town of Bengal; 35 miles S.E. of Doesa.

SOHLEN, a town of Westphalia; 6 miles S.S.W. of Magdeburg.

SOHNER, a town of Norway, in the province of Aggerhuus; 25 miles S. of Christiania.

SOHO. See **BIRMINGHAM**.

SOHR, a town of Bohemia, in the circle of Konigin-gratz; 6 miles S.E. of Arnau.

SOHRAU, or **ZYORX**, a town of Silesia, in the principality of Ratibor; 11 miles W.N.W. of Ples.

SOIATOI, a small island of Russia, in the Caspian sea; 148 miles S.E. of Astrachan. N. lat. 44° 40'. E. long. 50° 14'.

SOIGNIES, a town of France, in the department of the Jemmapes, and chief place of a canton, in the district of Mons, situated on the Senne, near a forest to which it gives name; 6 miles N.N.E. of Mons. The place contains 4247, and the canton 14,563 inhabitants, on a territory of 125 kilometres, in 9 communes.

SOIL, in *Agriculture*, a general name applied to the surface mouldy parts of all sorts of land, and in which the fine powdery materials, which have been gradually formed

SOIL.

by time from the various earthy and other bodies in nature, being ground down, and incorporated with each other in different states and proportions, constitute earthy layers, which are usually denominated soils, and which are destined to promote the growth and support of various vegetable crops: while the more solid and less reduced substances, which have been excluded from the influence of the atmosphere, and other natural causes, form the under stratum, which is commonly known by the title of sub-soil. On this account, it is evident that there must be a great diversity in the soils of different districts. The more compact and hard substances of nature, the reduction of which is effected in a more slow and gradual manner, are generally found more sparingly in the principles of soils, than those of the more soft and easily reducible kinds. But in the natural state of soils, the clayey, loamy, and vegetable materials are generally found to enter in a pretty large proportion, and to constitute very essential differences, according to the quantities in which they are predominant in them. And the earthy vegetable matter is, in many cases, a principal material in soils, constituting a sort of superficial layer or bed, in which the crops grow and are supported; but which differs greatly according to the quantity, and the state of reduction or decay to which it has advanced, as well as many other circumstances. (See *VEGETABLE Earth*.) Also, substances of the calcareous, siliceous, and sandy kinds, are abundantly prevalent in some tracts of country, while in others they are met with only in a very sparing manner, and thus of course afford much variety in the nature and properties of the soils of such situations. Other causes, which our limits will not allow us to mention in this place, contribute to produce very great varieties and diversities in the natures and compositions of soils.

It has been well observed by professor Davy, in an excellent paper on the Analysis of Soils, that the substances which are found in soils, are certain mixtures or combinations of some of the primitive earths, animal and vegetable matter in a decomposing state, certain saline compounds, and the oxyd of iron. These bodies always retain water, and exist in very different proportions in different lands, and the end of analytical experiments is the detection of their quantities and mode of union. But that the earths found in common soils are principally silex, or the earths of flints, alumina, or the pure matter of clay, lime, or calcareous earth and magnesia. That silex, or silica, or the earth of flints, when perfectly pure, appears in the form of a white powder, which is incombustible, infusible, insoluble in water, and not acted upon by common acids; it is the substance which constitutes the principal part of rock crystal; it composes a considerable part of hard gravelly soils, of hard sandy soils, and of hard stony lands.

That alumine, alumina, or pure clay, in its perfect state is white, like silex; it adheres strongly to the tongue, is incombustible, insoluble in water, but soluble in acids, and in fixed alkaline menstrua. It abounds most in clayey soils and clayey loams; but even in the smallest particles of these soils, it is usually united to silex and oxyd of iron.

That lime is the substance, which is well known in its pure state under the name of quicklime. It always exists in soils in combination, and that principally with fixed air or carbonic acid, when it is called carbonate of lime; a substance which, in the most compact form, constitutes marble, and in its looser form, chalk. Lime, when combined with sulphuric acid (oil of vitriol), produces sulphate of lime (gypsum), and with phosphoric acid, phosphate of lime. The carbonate of lime, mixed with other substances, com-

poses chalky soils and marles, and is found in soft sandy soils.

That magnesia, when pure, appears as white, and in a lighter powder than any of the other earths; it is soluble in acid, but not in alkaline menstrua; it is rarely found in soils; when it does exist, it is either in combination with carbonic acid, or with silex and alumine.

That animal decomposing matter exists in very different states, according as the substances from which it is produced are different; it contains much carbonaceous substance, and may be principally resolved by heat into this substance, volatile alkali, inflammable aeriform products, and carbonic acid; it is principally found in lands that have been lately manured.

That vegetable decomposing matter is likewise very various in its kind; it contains usually more carbonaceous substance than animal matter, and differs from it in the results of its decomposition, principally in not producing volatile alkali; it forms a great proportion of all peats; it abounds in rich mould; and is found in larger or smaller quantities in all lands.

That the saline compounds found in soils are very few, and in quantities so small that they are rarely to be discovered. They are principally muriate of soda (common salt), sulphate of magnesia (Epsom salt), and muriate and sulphate of potash, nitrate of lime, and the mild alkalies.

That the oxyd of iron is the same with the rust produced by exposing iron to the action of air and water; it is found in all soils, but is more abundant in yellow and red clays, and in yellow and red siliceous sands.

There is, besides these, sometimes oxyd of manganese, or manganese, found in soils, which is composed of this substance and oxygen. It is known from other matters met with in soils, by the property which it has of decomposing muriatic acid, and converting it into another substance.

The silex, or silica, is for the most part met with in soils in the state of combination with alumine, or alumina, and the oxyd of iron, or with the former, lime, magnesia, and oxyd of iron, constituting sand and gravel of very different degrees of fineness, as well as varying much in colour. The carbonate of lime is commonly found in an impalpable form; but occasionally in the state of calcareous sand. The magnesia, when not combined with the gravel or sand of the soil, is in general united in a fine powdery state to carbonic acid. The fine impalpable parts of soil, which are most commonly denominated clay or loam, consist, as has been seen, of silex or silica, alumine or alumina, lime, and magnesia; and are in reality, for the most part, of the same composition as the hard sand, but more finely divided in their particles. As to the vegetable and animal matters of soils, the former of which is by much the most common, they exist in many very different states of reduction and decomposition, as sometimes in that of a quite fibrous one, and at other times they are wholly broken down, and reduced so as to be intimately blended and incorporated with the earthy parts of the soils or lands.

The matters therefore which constitute soils are for the most part of a compound nature, and operate as such in the formation of them. They have many of them, likewise, some other qualities and properties, but which need not be noticed in this place.

It has also been stated by a late practical writer, that there are probably few, if any, substances in nature, which, after they have been sufficiently acted upon, and reduced by the influence of the atmosphere and other agents, that are not capable of affording support to some kind of vegetable or

SOIL.

other, though there is considerable difference in this respect among different earthy matters, some being liable to sustain a great number of different plants in a vigorous state of growth, almost immediately after they become mixed with the soil, while others require to be applied and united for a length of time before they afford sustenance to any kind of vegetable whatever, and even then only yield a scanty supply of nourishment, and that for the support of a few particular sorts of plants. Where the former sorts of materials are abundant, the soils are generally fertile and productive; but where the latter prevail, they are mostly sterile and unfriendly to vegetation. Also that soils, besides possessing the proper earthy matters, must be embued with other principles, such as the aqueous and carbonaceous, and have such a consistence and texture as will properly support the plants, as well as such proportions of the several materials as will admit of their being retained, and applied in such quantities as are suitable for the purposes of vegetation, according to the differences of climate in respect to moisture, and the varieties of situation in regard to the lands, in order to be rich, fruitful, and productive, in the different kinds of vegetable crops. It has been stated likewise, that the bodies or materials, so far as they are yet known, that have a tendency to lessen the fertility of soils, are the oxyds or calces of particular metals, some coaly and pyritical matters, acids, and certain heathy vegetable substances. But that some of these substances, though unfriendly to the growth of vegetables, when in these circumstances, on being blended and united with other materials that enter into the composition of soils, operate upon them in such a manner as to render them more fertile than they would have been without them. Mixtures and impregnations of this nature are constantly taking place in soils, which cannot be easily comprehended or ascertained, but which produce great and important effects and changes in them. From this cause, soils which are apparently similar in every respect, on being brought into cultivation, frequently turn out to be essentially different. And it is well known to most persons conversant with practical agriculture, that soils in which calcareous matter is predominant, even when they are grown so poor and exhausted as to be almost incapable of producing any of the other crops commonly cultivated on them, will bear large and repeated crops of one sort of vegetable, that of sainfoin; and that other soils which are capable of affording the common crops in an abundant manner, cannot be made to produce this. In the same way, such calcareous soils as have been cultivated for a great length of time, and are consequently much impregnated with manure, afford plentiful crops of barley; while oat-crops, if attempted to be raised upon them in such a situation, are weak, puny, and relatively extremely small. And, on the contrary, some primitive soils, not originally containing any calcareous materials, and which, not having been cultivated, cannot be impregnated with manures on first being broken up, often yield astonishing crops of oats, while barley can scarcely be raised at all upon them. These and many other similar facts, noticed by cultivators of the soil, sufficiently shew the effects which even trifling mixtures of certain matters have in altering their qualities, and rendering them more or less fertile, as well as more or less proper for the growth of particular sorts of crops without there being any external appearance of such alteration. Further, soils are also found to differ greatly from their depths, and the nature of the sub-soils on which they rest. It is stated as a fact well known by practical farmers, and which the experience of every day confirms, that even the soils that are constituted of the most

suitable substances for the purposes of vegetation, when only a few inches in depth, and deposited upon beds of cold wet clay, rock, or chalk, are by no means so fruitful and productive as those which are thicker, though of inferior quality, but resting on a bottom which is more dry and gravelly. The difference of weight and tenacity in the under strata of soils, likewise introduces great variety in regard to their powers and capabilities of raising and rearing vegetable productions in the way of crops upon them.

The variations in the weights of soils are very material, as they shew in some measure the quantities of animal and vegetable matters with which they are impregnated in different cases, the lighter sorts being in most instances the most abundant in such substances. The variations in their powers and properties of dissipating or holding the moisture which they contain are also very material and important, as they denote, in some degree, the nature of their compositions, and their utility for the growth of different sorts of plants as crops.

The nature and variations of soils, in so far as they are more or less capable of imbibing and retaining the principles of heat, or more *cold* and raw, or *warm* in their qualities, which are by no means absurdities or prejudices, as some have supposed, are highly deserving of the attention of the philosophical farmer, as some soils are evidently much more heated by the effects of the sun than others, all other circumstances being the same, while soils brought to the same state of heat cool in different lengths of time, or some much faster than others. This property, which has hitherto been but little attended to, is thought to be probably of considerable importance by the above writer on chemistry. It is conceived, that in general soils that consist principally of a stiff white clay are difficultly heated; and that, being commonly very moist, they retain their heat only for a very short time. Chalky soils are similar in one particular, which is that of their being heated with difficulty; but being drier they retain their heat longer, less being supposed to be consumed in producing the evaporation of their moisture.

It has been found that a black soil, which contained much soft vegetable matter, was most heated by the sun and air; and that the coloured soils, and those containing a large proportion of carbonaceous or ferruginous matter, when exposed under equal circumstances to the sun, acquire a much higher temperature than pale-coloured soils.

In all cases, when soils are perfectly dry, those that are the most readily heated by the power of the sun, cool likewise in the most ready manner; but sir Humphrey Davy has experimentally ascertained, that the darkest coloured dry soil, or that which contains abundance of animal and vegetable matter; substances which most facilitate the diminution of temperature, when heated to the same extent, provided it be within the common limits of the effects of the sun's heat, will cool more slowly than a wet pale soil, wholly composed of earthy matter. He found that a rich black mould, which contained nearly a fourth part of vegetable matter, had its temperature increased in the course of an hour from 65° to 88° , by exposure to the sun-shine; while a chalk soil was heated only to 69° under the same circumstances and length of time. But the mould removed into the shade where the temperature was 62° , lost, in half an hour, 15° ; while the chalk, under the same circumstances, had lost only 4° . Farther, a brown fertile soil and a cold barren clay were each artificially heated to 88° , having been previously dried: they were then exposed in a temperature of 57° ; in half an hour the dark soil was found to have lost 9° of heat; the clay had lost only 6° . An equal portion of the clay containing moisture,

moisture, after being heated to 88° , was exposed in a temperature of 55° ; in less than a quarter of an hour it was found to have gained the temperature of the room. In all these trials the soils were put upon small trays made of tin-plate two inches square and half an inch in depth, the temperature being ascertained by a thermometer of a very delicate kind.

It is upon the whole supposed, that nothing can be more evident, than that the genial heat of the soil, particularly in the spring season, must be of the greatest and most material use and importance to the raising plants as crops. And that when the leaves are fully and completely developed or spread out, the ground or land is considerably shaded; and any injurious influence or consequence, which in the summer season might have been apprehended from too great a heat, wholly prevented: so that the temperature of the surface, when bare and exposed to the effects of the sun, affords at least, it is supposed, one indication of the state of its fertility; and that the thermometer may therefore be, it is believed, sometimes an useful instrument to the purchaser as well as improver of lands.

The moisture present in soils has likewise an effect and influence on their temperatures; and the particular manner or method in which it is distributed through, or combined with, the earthy, or perhaps other materials, is of great consequence and importance, in so far as it relates to the nourishment of the plants which grow upon them. The above chemico-agricultural writer thinks, that where the water is too strongly attracted by the earths, it will not be absorbed by the roots of the plants; and that where it is in too great quantity, or too loosely united to them, it will tend to injure or destroy the fibrous parts of the roots. In his opinion there are two states in which water seems to exist in the earths, and in animal and vegetable substances: in the first state, it is conceived to be united by chemical, in the other by cohesive attraction. The former of these is illustrated by the pouring of pure solutions of ammonia or potassa into those of alum, when the alumine or alumina falls down combined with water; and the dry powder affording, by distillation, more than half its weight of water. Also, by the moisture which wood, muscular fibre, and gum, that have been heated to 212° , afford in the same way at a red heat, which is likewise water held in the same manner.

The latter is shewn, it is supposed, when dried pipe-clay, at the temperature of the atmosphere, is brought into contact with water, as the last is rapidly absorbed. In general too, soils, as well as vegetable and animal substances that have been dried at a heat below that of boiling water, increase in weight by exposure to the air, in consequence of their absorbing water from it, which is in the state of vapour, on account of this sort of attraction.

The water which is *chemically* combined among the principal component parts of soils, unless in the case of the decomposition of animal or vegetable substances, cannot, it is supposed, be absorbed by the roots of plants; but that which *adheres* to the parts of the soil is in constant use in vegetation. Indeed, it is believed that there are few earthy mixtures met with in soils that contain any chemically combined water; water is expelled from the earths by most substances that combine with them. As for instance, when a combination of lime and water is exposed to carbonic acid, that fluid substance takes the place of the water; and compounds of alumina and silica, or others of the earths, do not chemically unite with water; and soils, as has been seen, are formed either by earthy carbonates, or compounds of pure earths and metallic oxyds.

However, when saline substances exist in soils, they may, it is said, be united to water, both chemically and mechanically; but they are always, it is supposed, in too small a proportion to materially influence the relations of the soils to water.

The power or capability of the soil to absorb and receive water, in consequence of this sort of attraction, depends greatly upon the state of division of its parts; as the finer and more minute this is, the greater and more powerful is the capacity for absorption. The different constituent parts of soils seem likewise to operate, even by this kind of attraction, with different degrees of force and energy. In this way vegetable substances seem, it is said, to be more absorbent than animal substances; animal substances more so than compounds of alumina and silica; and compounds of alumina and silica more absorbent than carbonates of lime and magnesia. These differences may, however, it is suggested, possibly depend upon the differences in their states of division, and on the surface which is exposed.

This power or capability of soils to absorb water from the air is, it is supposed, much connected with fertility. The soils which are the most efficient in supplying plants with water, by means of atmospheric absorption, are, it is said, those in which there is a due and proper mixture of sand, finely divided clay, and carbonate of lime, with some animal and vegetable matter; and which are so loose and light as to be freely and readily permeable to the atmosphere. In so far as regards this quality, carbonate of lime, and animal and vegetable matter, are, it is said, of great use in soils. They give absorbent power to them, without at the same time giving tenacity: sand, too, constantly destroys tenacity, but, on the contrary, affords little power of absorption. The above writer has compared the absorbent powers of many soils, in so far as it relates to atmospheric moisture, and has constantly found it to be the greatest in the most fertile of them; so that it is supposed to afford one mode of judging of the productiveness of land.

Thus, the water, and the decomposing animal and vegetable matter existing in the soil, constitute, it is supposed, the true nourishment of plants; and that as the earthy parts of the soil are useful in retaining water, so as to supply it in the proper proportions to the roots of the vegetables, so they are likewise efficacious in producing the proper distribution of the animal or vegetable matter. When equally blended and intermixed with it, they also prevent it from decomposing in too rapid a manner; and by their means the soluble parts are supplied in proper proportions or quantities. But besides this agency, which may be considered as mechanical, the writer conceives that there is another, between soils and organizable matters, which may be regarded as chemical in its nature. The earths, and even the earthy carbonates, have, it is said, a certain degree of chemical attraction for many of the principles of vegetable and animal substances, as is readily exemplified in the case of alumina and oil: for when an acid solution of alumina is mixed with a solution of soap, which consists of oily matter and potassa, the oil and the alumina will unite and form a white powder, which will sink to the bottom of the fluid which holds it. The extract, too, from decomposing vegetable matter, when boiled with pipe-clay or chalk, forms, it is said, a combination by which the vegetable matter is rendered more difficult of decomposition and solution. Pure silica and siliceous sands have, it is remarked, little action of this kind; and the soils which contain the most alumina and carbonate of lime, are those which act with the greatest chemical energy in preserving manures. Such soils are supposed to deserve the appellation which is commonly given to them, of rich soils:

soils; as the vegetable nourishment is long preserved in them, unless when taken up by the organs of plants. Siliceous sands, on the contrary, are thought to merit the term hungry, which is commonly applied to them; as the vegetable and animal matter they contain, not being attracted by the earthy constituent parts of the soil, are more liable to be decomposed by the action of the atmosphere, or carried off or away from them by water in different ways. In most of the black and brown rich vegetable moulds, the earths seem, it is supposed, to be in combination with a peculiar extractive matter, afforded during the decomposition of vegetables. This is slowly taken up, or attracted, it is believed, from the earths by water, and appears to constitute a prime cause of the fertility of the soil. The standard of fertility of soils for different plants must vary, it is supposed, with the climate, and must be particularly influenced by the quantity of rain. The power of soils to absorb moisture ought, it is said, to be much greater in warm or dry countries than in cold and moist ones, and the quantity of clay or vegetable or animal matter they contain greater. Such soils as are on declivities, also, should be more absorbent than those on plains, or in the bottoms of vallies. Their productiveness is likewise influenced by the nature of the sub-soil, or the stratum on which they rest. When soils are immediately situated upon a bed of rock or stone, they are much sooner, it is said, rendered dry by evaporation, than when the sub-soil is of clay or marle; and a principal cause of the great fertility of the land in the moist climate of Ireland is, it is imagined, the proximity of the rocky strata to the soil. A clayey sub-soil will sometimes, it is thought, be of material advantage to a sandy soil; and in this case it will retain moisture, in such a manner as to be capable of supplying that lost by the earth above, in consequence of evaporation, or the consumption of it by plants as crops. A sandy or gravelly sub-soil often corrects the imperfections of too great a degree of absorbent power in the true soil. In calcareous countries, where the surface is a kind of marle, the soil is often found, it is observed, only a few inches above the limestone, yet its fertility continues unimpaired by the proximity of the rock; though in a less absorbent soil, this situation would occasion barrenness: and thus the sandstone and limestone hilly soils, in some western districts, may be readily distinguished at a distance, in the summer season, by the different tints or casts of colour in the vegetation. On the sandstone kind it will commonly appear brown and burnt up; while on the limestone sort, it will be green and flourishing in a considerable degree.

It not unfrequently happens that soils are met with in a quite unaltered state, upon the rocks from which they were produced. The manner in which they were formed may easily be conceived, it is supposed by sir Humphrey Davy, by referring to the case of *soft* or *porcelain granite*, which consists of three ingredients, quartz, felspar, and mica. The quartz he considers as almost pure siliceous earth, in a crystalline form. The felspar and mica are very compounded substances: both contain silica, alumina, and oxyd of iron; in the former there is commonly lime and potassa; in the latter, lime and magnesia. Therefore, when a granite rock of this sort has been long exposed to the influence of air and water, he supposes the lime and potassa, contained in its constituent parts, are acted upon by water or carbonic acid; and the oxyd of iron, which is mostly in the least oxyded state, tends to combine with more oxygen; in consequence of which the felspar decomposes, as well as the mica, but the first in the most rapid manner. The felspar, which is as it were the cement of the stone, forms a fine clay; the

partially decomposed mica blends and intermixes with it as sand; and the undecomposed quartz appears as gravel, or sand of different degrees of fineness. On the smallest layer of earth being formed on the surface of the rock, the seeds of mosses, and other imperfect plants, which are mostly floating in the surrounding atmosphere, and which have made it their resting place, begin, it is said, to vegetate; and their decay, death, and decomposition afterwards, afford a certain quantity of organizable matter, which mixes with the earthy materials of the rock. In this improved soil, more perfect plants are capable of subsisting: these, in their turn, absorb nourishment from the water of the atmosphere; and, after perishing, afford new materials to those already provided. The decomposition of the rock still continues; and at length, by such slow and gradual processes, a soil is formed, in which even forest trees can, it is supposed, fix their roots, and which is fitted to reward the labours of those undertaking its cultivation.

It is likewise noticed, that where successive generations of vegetables have grown upon a soil, unless part of their produce has been carried away by man, or consumed by animals, the vegetable matter increases in such proportion, that the soil approaches to a peat in its nature; and if it be so placed as that it becomes impregnated with water from a higher situation, it gets spongy, and is gradually rendered incapable of supporting better plants. A great number of peat mosses appear, however, it is said, to have been formed by the destruction of forests, by the imprudent use of the hatchet, at some early former period. It is supposed, that when the trees in the outer parts of the woods were cut down, those in the interior were exposed to the influence of the winds; and, having been accustomed to shelter, became unhealthy, and died in their new situations; the leaves and branches of which, gradually decomposing, produced a stratum of vegetable matter. In several of the great peat bogs in the north of this and the neighbouring country, the larger trees met with on the outer parts of them, it is said, bear the marks of having been felled; while in the interior, few entire trees are found: and the cause is, probably, it is supposed, that they fell by gradual decay; and that the fermentation and decomposition of the vegetable matter were most rapid, where it was in the greatest quantity or proportion.

Other less healthy sorts of spurious peat bogs are formed in watery situations, by the accumulation of the remains of aquatic plants. There is here a fermentation of an apparently different kind, and a much greater evolution of gaseous matter.

It is found that the earthy matter of peats is invariably analogous to that of the stratum on which they repose: the plants which have formed them must have derived the earths that they contained from this stratum. Thus, the above writer observes, that in the counties of Wilts and Berks, where the stratum below the peat is chalk, calcareous earth abounds in the ashes, and very little alumina and silica: They likewise contain much oxyd of iron and gypsum, both of which may be derived from the decomposition of pyrites, which is so abundant in chalk. The different specimens of peat that have been burnt by this experimenter, from the granitic and schistose soils of different parts of these islands, have constantly given him ashes principally of a siliceous and aluminous nature; but one from the county of Antrim, in Ireland, yielded ashes, which afforded very nearly the same constituent parts as the great basaltic stratum of the county.

It is suggested that poor and hungry soils, such as are produced from the decomposition of granitic and sandstone rocks,

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rocks, remain very often for ages with only a thin covering of vegetation; but that soils from the decomposition of limestone, chalk, and basalt, are not unfrequently clothed by nature with the perennial grasses, and afford, when ploughed up, a rich bed of vegetation for every sort of cultivated plants.

From what has been said on the formation of rocky soils, it must be obvious that they are as various as the rocky matters from which they are produced, and probably much more so, in consequence of the alterations which have taken place in them, from the continued operation of water, and different other causes.

In so far as the cropping of land is concerned, it must be evident that no general principle can be laid down for it, unless the whole of the circumstances connected with the nature, composition, and situation of the soils, as well as subsoils, be fully understood.

In like manner, in the above writer's opinion, the modes of cultivation in different soils must be different; as the same practice that may be excellent in one case may be destructive in others. Thus, for instance, deep ploughing may be very advantageous and profitable in rich thick soils; but in fertile shallow ones, upon cold clay or sandy sub-soils, very injurious and hurtful. Siliceous sandy soils are much more productive in moist wet climates, where the fall of rain is great, such as those in the south-west and north-west of this country, and in some places in Ireland, than in dry districts; and in such situations, wheat and beans will require less coherent and absorbent soils than in those which are drier; and bulbous-rooted plants will, it is said, thrive well in soils that have as many as fourteen parts out of fifteen of sand. The exhausting powers of crops, too, it is asserted, will be influenced by the same circumstances; as where sufficient moisture cannot be absorbed by plants, they must necessarily take up more manure. In the south-western and north-western parts of this island, as well as in Ireland, corn will, it is said, exhaust less than in dry inland districts; and oats are much more deteriorating, especially in dry climates, than in such as are moist. In many other instances, the same is likewise the case.

In regard to the constitution or composition of fertile soils, the first essential requisite, according to Mr. Kirwan, is, that it contain a sufficient quantity of the three or four simple earths above mentioned, and of the soluble carbonaceous principle; and that the other requisites are, that the proportion of each, and the general texture of the soil, be such as to enable it to admit and retain as much water as is necessary to vegetation, and no more. Also, further, that as it has been seen that the retentive powers of moisture are very different in the simple earths, the proportions in which the fertility of a soil requires them to be mixed must be different in climates and countries that differ considerably in moisture; in the *drier*, they must be such as are most retentive; in the *moister*, such as suffer it to pass or evaporate more easily. The same remark also extends to situation. Lands on a plain should be so constituted, as to be less retentive of water than those situated on a declivity; as has been seen, and is very evident: consequently, lands that have a retentive or impermeable sub-soil, should be differently constituted from those that have one less retentive, or more permeable. And the time of the year in which rain most abundantly falls may also be worthy of notice, in adjusting this business.

From a variety of facts and observations, which we cannot minutely detail, it is inferred that in the drier countries, where the fall of rain is but 20 inches, the soil, to be fertile, must be closer, and the quantity of calcareous earth

much increased, and that of the siliceous earth much diminished. Thus, in the climate of Turin, where the fall of rain exceeds 40 inches, the proportion of siliceous earth is from 77 to 80 *per cwt.*, and that of calcareous from 9 to 14, to suffer this excess of rain more easily to evaporate. In the climate of Upsal, where the fall of rain is 24 inches, the proportion of siliceous is only 56 *per cwt.*, but that of calx is 30; and in the climate of Paris, which is still drier, the proportion of siliceous is only from 46 to 51, and that of calx 37.5 *per cwt.* And hence we may perceive the necessity of attending to the average quantity of rain, to judge of the proper constitution of fertile lands upon fixed principles. The quantity of rain differs much, in different parts of the same kingdom; but in general, in Ireland, Mr. Kirwan believes it to be between 24 and 28 inches, on an average. In the two last mixtures, the proportions vary considerably: the first may serve, it is said, as a model for the heavier soils; and the second for the lighter. In the following experiments, the carbonic principle seems to have been extracted from the surrounding garden-mould, with which the pots communicated, by means of their perforation at the bottom.

The author of a late work on "Agricultural Chemistry" states, that as plants have no locomotive powers, they can only grow in places where they are supplied with food; and that the soil is necessary to their existence, both as affording them properly the means of nourishment, and enabling them to fix themselves in such a manner as to obey those mechanical laws, by which their radicles are kept below the surface, and their leaves exposed to the free atmosphere. That as the systems of roots, branches, and leaves, are very different in different vegetables, so they flourish most perfectly in different soils suited to them: the plants that have bulbous roots require a looser and a lighter soil than such as have fibrous roots; and the plants having only short fibrous radicles stand in need of a firmer soil than such as have tap-roots, or extensive roots of the lateral kind.

He found a good turnip soil from Holkham, in the county of Norfolk, to afford eight out of nine parts siliceous sand; and the finely divided matter to consist of

Carbonate of lime	63
Silica	15
Alumina	11
Oxyd of iron	3
Vegetable and saline matter	5
Moisture	3

A soil particularly fitted for raising flourishing oaks, to be constituted nearly as noticed afterwards, below.

An excellent wheat-soil from near West Drayton, in the county of Middlesex, gave three parts in five of siliceous sand; and the finely divided matter consisted of

Carbonate of lime	28
Silica	32
Alumina	29
Animal or vegetable matter and moisture	11

It is noticed, that of these soils, the first was the least coherent in texture, and the last by far the most so. In all cases, the constituent parts of the soil which give tenacity and coherence are, it is said, the finely divided matters; and that they possess the power of giving those qualities in the highest degree, when they contain much alumina. A small quantity of finely divided matter is sufficient, it is said, to fit a soil for the production of turnips and barley; and the writer has seen a tolerable crop of turnips on a soil containing

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taining eleven parts out of twelve sand. Any much greater proportion of sand, however, it is stated, always produces absolute sterility. The soil of Bagshot-Heath, which is wholly devoid of vegetable covering, contains, it is said, less than one-twentieth of finely divided matter; 400 parts of it, which had been heated red, afforded the above writer 380 parts of coarse siliceous sand, 9 parts of fine sand of the same kind, and 11 parts of impalpable matter, which was a mixture of ferruginous clay, with carbonate of lime. Vegetable or animal matters, when finely divided, not only give, it is said, coherence, but likewise softness and penetrability; but neither they, nor any other part of the soil, must be in too great proportion; and a soil is unproductive, if it consists entirely of impalpable matter. Pure alumina or silica, pure carbonate of magnesia, are incapable of supporting healthy vegetation. And no soil is fertile, it is stated, that contains so much as nineteen parts out of twenty of any of the constituent materials that have been mentioned above.

In answer to the important question, whether the pure earths in the soil only act in a mere mechanical manner, or as indirect chemical agents, or actually furnish the food of the plants? it is stated, that as their bases have not yet been decomposed, there is no reason to suppose that they are capable of being converted into the elements of organized compounds, as into carbon, hydrogen, and azote. Plants have been made to grow, it is said, in given quantities of earth, but they consume very small portions only; and what is lost may be accounted for, by the quantities found in their ashes, that is to say, it has not been converted into any new products. The carbonic acid united to lime or magnesia, if any stronger acid happens to be formed in the soil during the fermentation of vegetable matter, which will disengage it from the earths, may, it is said, be decomposed; but the earths themselves cannot be supposed convertible into other substances, by any process taking place in the soil or land. In all cases, the ashes of plants, it is observed, contain some of the earths of the soil in which they grow; but these never equal more than one-fiftieth of the weight of the plant which is consumed. On the whole, it is concluded, that if they be considered as necessary to the vegetable, it is as giving hardness and firmness to its organization. Thus wheat, oats, and many of the hollow grasses, have, it is said, an epidermis principally of siliceous earth; the use of which seems to be to strengthen them, and defend them from the attacks of insects and parasitical plants.

It is stated that, for the most part, the soils, the constituent materials of which are the most various and contrary to each other, are those of the alluvial kind, or which have been formed in a gradual manner from the depositions of rivers, or other waters: they are, in many cases, extremely fertile. The writer just mentioned has examined some productive soils of this sort, which have been very different in their composition. A very productive soil from the banks of the river Parrot, in the county of Somerset, afforded eight parts of finely divided earthy matter, and one part of siliceous sand: the analysis of the former gave these results:

- 360 parts of carbonate of lime,
- 25 parts of alumina,
- 20 parts of silica,
- 8 parts of oxyd of iron,
- 19 parts of vegetable, animal, and saline matter.

A rich soil of this nature from near the Avon river, in the valley of Evesham, in the county of Worcester, gave

three-fifths of fine sand, and two-fifths of impalpable matter: the latter consisted of

- 35 Alumina,
- 41 Silica,
- 14 Carbonate of lime,
- 3 Oxyd of iron,
- 7 Vegetable, animal, and saline matter.

From a specimen of good soil of Tiviotdale, five-sixths of fine siliceous sand, and one-sixth of impalpable matter, were afforded: the latter consisted of

- 41 Alumina,
- 42 Silica,
- 4 Carbonate of lime,
- 5 Oxyd of iron,
- 8 Vegetable, animal, and saline matter.

And a soil affording excellent pasture from the valley of the Avon, near the town of Salisbury, gave one-eleventh of coarse siliceous sand; the finely divided matter of which consisted of

- 7 Alumina,
- 14 Silica,
- 63 Carbonate of lime,
- 2 Oxyd of iron,
- 14 Vegetable, animal, and saline matter.

It is stated that, in all these cases, the fertility seemed to depend upon the state of division and mixture of the earthy materials and the vegetable and animal matters; which may be readily explained from what has been already advanced.

And professor Davy, in speaking of the improvement of soils, as connected with the principle of their composition, remarks in the paper noticed above, that when a barren soil is examined with a view to its improvement, it ought, in all cases, if possible, to be compared with an extremely fertile soil in the same neighbourhood, and in a similar situation: the difference given by their analyses would indicate the methods of cultivation; and thus the plan of improvement would be founded upon accurate scientific principles. And that, if the fertile soil contained a large quantity of sand, in proportion to the barren soil, the process of amelioration would depend simply upon a supply of this substance; and the method would be equally simple with regard to soils deficient in clay or calcareous matter. But that in the application of clay, sand, loam, marle, or chalk to lands, there are no particular chemical principles to be observed; but when quicklime is used, great care must be taken that it is not obtained from the magnesian limestone; for in this case, as has been shewn by Mr. Tennant, it is exceedingly injurious to land. The magnesian limestone may be distinguished from the common limestone by its greater hardness, and by the length of time that it requires for its solution in acids, and it may be analysed by the process for carbonate of lime and magnesia. When the analytical comparison indicates an excess of vegetable matter as the cause of sterility, it may be destroyed by much pulverization, and exposure to air, by paring and burning, or the agency of lately made quicklime. And the defect of animal and vegetable matter must be supplied by animal or vegetable manure.

And it is further stated, that sterile soils in different climates and situations must differ in composition. The general indications of fertility and barrenness, as found by chemical experiments, must necessarily differ in different climates, and under different circumstances. The power of soils to absorb moisture, a principle essential to their productiveness,

ductiveness, ought, as has been seen, to be much greater in warm and dry countries, than in cold and moist ones; and the quantity of fine aluminous earth they contain larger. Soils, likewise, as already seen, that are situated on declivities, ought to be more absorbent than those in the same climate, on plains or in vallies. The productiveness of soils must likewise be influenced by the nature of the sub-soil, or the earthy or stony strata on which they rest; and this circumstance ought to be particularly attended to in considering their chemical nature, and the system of improvement. Thus, a sandy soil may sometimes owe its fertility to the power of the sub-soil to retain water; and an absorbent clayey soil may occasionally be prevented from being barren, in a moist climate, by the influence of a sub-stratum of sand or gravel. In regard to the chemical composition of fertile corn-soils in this climate, those soils that are most productive of corn, contain always certain proportions of aluminous and calcareous earth, in a finely divided state, and a certain quantity of vegetable or animal matter. The quantity of calcareous earth is however very various, and in some cases exceedingly small. A very fertile corn-soil from Ormiston, in East Lothian, afforded the writer, in an hundred parts, only eleven parts of mild calcareous earth; it contained twenty-five parts of siliceous sand; the finely divided clay amounted to forty-five parts. It lost nine in decomposed animal and vegetable matter, and four in water; and afforded indications of a small quantity of phosphate of lime. This soil was of a very fine texture, and contained very few stones or vegetable fibres. It is not unlikely that its fertility was in some measure connected with the phosphate; for this substance is found in wheat, oats, and barley, and may be a part of their food. A soil from the low lands of Somersetshire, celebrated for producing excellent crops of wheat and beans without manure, he found to consist of one-ninth of sand, chiefly siliceous, and eight-ninths of calcareous marl tinged with iron, and containing about five parts in the hundred of vegetable matter. He could not detect in it any phosphate or sulphate of lime, so that its fertility must have depended principally upon its power of attracting principles of vegetable nourishment from water and the atmosphere. And Mr. Tillet found that a soil composed of three-eighths of clay, two-eighths of river-sand, and three-eighths of the parings of limestone, was very proper for wheat.

With respect to the composition of soils proper for bulbous roots and for trees, it is observed that, in general, bulbous roots require a soil much more sandy, and less absorbent, than the grasses. A very good potatoe soil, from Varfel, in Cornwall, afforded him seven-eighths of siliceous sand; and its absorbent power was so small, that one hundred parts lost only two by drying at 400° Fahrenheit. Plants and trees, the roots of which are fibrous and hard, and capable of penetrating deep into the earth, will vegetate to advantage in almost all common soils which are moderately dry, and which do not contain a very great excess of vegetable matter. He found the soil taken from a field at Sheffield-Place, in Suffex, remarkable for producing flourishing oats, to consist of six parts of sand, and one part of clay and finely divided matter. And one hundred parts of the entire soil submitted to analysis, produced

Substances.		Parts.
Water	-	3
Silix	-	54
Alumine	-	28
Carbonate of lime	-	3
Oxyd of iron	-	5
Decomposing vegetable matter	-	4
Loss	-	3

And on the advantages of improvements made by changing the composition of the earthy parts of soils, it is observed that, from the great difference of the causes that influence the productiveness of lands, it is obvious that, in the present state of science, no certain system can be devised for their improvement, independent of experiment: but there are few cases in which the labour of analytic trials will not be amply repaid by the certainty with which they denote the best methods of amelioration; and this will particularly happen, when the defect of composition is found in the proportions of the primitive earths. In supplying animal or vegetable manure, a temporary food only is provided for plants, which is in all cases exhausted by means of a certain number of crops; but when a soil is rendered of the best possible constitution and texture, with regard to its earthy parts, its fertility may be considered as permanently established. It becomes capable of attracting a very large proportion of vegetable nourishment from the atmosphere, and of producing its crops with comparatively little labour and expence.

There are different other cases in which improvements may be directed in this way; as where the salts of iron or some acid material is found to prevail in soils, they may be altered and corrected by the use of lime in its most active state. In this manner very sterile soils, not deficient in texture, have been effectually improved. When the quantity of calcareous matter is too great, sand or clay is the obvious remedy. If there be a deficiency of vegetable materials in light sandy or gravelly soils, they may be permanently improved by the use of peat earth upon them. The peat-boggy and marshy sorts of soils, after proper draining, are mostly made productive, by laying upon them sandy, or stiff earthy matters in due proportion, especially when the former are of the black soft peaty quality. In cases where peaty soils are acid, or much impregnated with ferruginous saline matters, the use of calcareous substances is essentially necessary for bringing them into proper order.

It is conceived that the best natural soils are those, the materials of which have been produced from strata of different kinds, which have been the most perfectly divided in their parts by the operation of air and water, and are the most intimately blended and incorporated together. In improving soils artificially, it is in short supposed, that the farmer cannot do better than imitate the processes of nature. The materials suitable for the purpose are, it is said, seldom far distant: coarse sand is often found immediately upon chalk; and beds of sand and gravel are commonly below clay.

The labour of amending and improving the texture and constitution of soils, is repaid, it is said, by many great permanent benefits; a smaller quantity of manure is required, and their fertility rendered secure, &c.

In order to ascertain the properties and qualities of land, the method of chemical analysis has been adopted. In this case the following rules and directions, laid down by professor Davy in the paper before alluded to, may be found useful in guiding the inquirer. All the varieties of soils may be analysed in this way.

1. *Instruments required for the Analysis of Soils.*—The really important instruments required for the analysis of soils are, in his opinion, few, and but little expensive. They are, a balance capable of containing a quarter of a pound of common soil, and capable of turning, when loaded, with a grain; a series or set of weights, from a quarter of a pound troy to a grain; a wire sieve, sufficiently coarse to admit a pepper-corn through its apertures; an Argand lamp and

stand; some glass-bottles; Hessian crucibles; porcelain or queen's ware evaporating basins; a Wedgewood pebble and mortar; some filters made of half a sheet of blotting-paper, folded so as to contain a pint of liquid, and greased at the edges; a bone-knife, and an apparatus for collecting and measuring aeriform fluids. And the chemical substances or re-agents required for separating the constituent parts of the soil are, muriatic acid (spirit of salt), sulphuric acid, pure volatile alkali dissolved in water, solution of prussiat of potash and iron, succinate of ammonia, soap-ley, solutions of carbonate of ammonia, of muriate of ammonia, solution of neutral carbonate of potash, and nitrate of ammonia. An account of the nature of these bodies and their effects may be found in Dr. Thomson's *Sytem of Chemistry*, and Henry's *Epitome*; and the re-agents are sold together with the instruments mentioned above, by Mr. Knight, Folterlane, Cheapside, arranged in an appropriate chest.

2. *Mode of collecting Soils for Analysis.*—In cases where the general nature of the soil of a field is to be ascertained, specimens of it should be taken from different places, two or three inches below the surface, and examined as to the similarity of their properties. It sometimes happens, that upon plains, the whole of the upper stratum of the land is of the same kind, and in this case one analysis will be sufficient; but in vallies, and near the beds of rivers, there are very great differences, and it now and then occurs that one part of a field is calcareous, and another part siliceous; and in this case, and in analogous cases, the portions different from each other should be separately submitted to experiment. Soils, when collected, if they cannot be immediately examined, should be preserved in phials quite filled with them, and closed with ground-glass stoppers. The quantity of soil most convenient for a perfect analysis, is from two to four hundred grains. It should be collected in dry-weather, and exposed to the atmosphere till it becomes dry to the touch. The specific gravity of a soil, or the relation of its weight to that of water, may be ascertained by introducing into a phial, which will contain a known quantity of water, equal volumes of water and of soil, and this may be easily done by pouring in water till it is half full, and then adding the soil till the fluid rises to the mouth; the difference between the weight of the soil and that of the water will give the result. Thus, if the bottle contains 400 grains of water, and gains 200 grains when half filled with water and half with soil, the specific gravity of the soil will be 2; that is, it will be twice as heavy as water; and if it gained 165 grains, its specific gravity would be 1.825, water being 1000. It is of importance that the specific gravity of a soil should be known, as it affords an indication of the quantity of animal and vegetable matter it contains; these substances being always most abundant in the lighter soils. The other physical properties of soils should likewise be examined before the analysis is made, as they denote, to a certain extent, their composition, and serve as guides in directing the experiments. Thus, siliceous soils are generally rough to the touch, and scratch glass when rubbed upon it; ferruginous soils are of a red or yellow colour; aluminous soils adhere strongly to the tongue, and emit a strong earthy smell when breathed on; and calcareous soils are soft, and much less adhesive than aluminous soils.

3. *Mode of ascertaining the Quantity of Water of Absorption in Soils.*—Soils, though as dry as they can be made by continued exposure to air, in all cases still contain a considerable quantity of water, which adheres with great obstinacy to the earths and animal and vegetable matter, and can only be driven off from them by a considerable

degree of heat. The first process of analysis is, to free the given weight of soil from as much of this water as possible, without, in other respects, affecting its composition; and this may be done by heating it for ten or twelve minutes over an Argand's lamp, in a basin of porcelain, to a temperature equal to 300° Fahrenheit. In several experiments, in which this process has been carried on by distillation, he has found the water that came over pure, and no sensible quantity of other volatile matter was produced. And in case a thermometer is not used, the proper degree may be easily ascertained, by keeping a piece of wood in contact with the bottom of the dish; as long as the colour of the wood remains unaltered, the heat is not too high; but when the wood begins to be charred, the process must be stopped. A small quantity of water will perhaps remain in the soil, even after this operation, but it always affords useful comparative results; and if a higher temperature were employed, the vegetable or animal matter would undergo decomposition, and in consequence the experiment be wholly unsatisfactory. The loss of weight in the process should be carefully noted, and when in four hundred grains of soil it reaches as high as fifty, the soil may be considered as in the greatest degree absorbent, and retentive of water, and will generally be found to contain a large proportion of aluminous earth. When the loss is only from twenty to ten, the land may be considered as only slightly absorbent and retentive, and the siliceous earth as probably most abundant.

4. *The Separation of Stones, Gravel, and vegetable Fibres from Soils.*—None of the loose stones, gravel, or large vegetable fibres, should be divided from the pure soil, till after the water is drawn off; for these bodies are themselves often highly absorbent and retentive, and in consequence influence the fertility of the land. The next process, however, after that of heating, should be their separation, which may be easily accomplished by the sieve, after the soil has been gently bruised in a mortar. The weights of the vegetable fibres of wood, and of the gravel and stones, should be separately noted down, and the nature of the last ascertained; if calcareous, they will effervesce with acids; if siliceous, they will be sufficiently hard to scratch glass; and if of the common aluminous class of stones, they will be soft, easily scratched with a knife, and incapable of effervescing with acids.

5. *Separation of the Sand and Clay, or Loam, from each other.*—The greater number of soils, besides gravel and stones, contain larger or smaller proportions of sand of different degrees of fineness; and it is a necessary operation, the next in the process of analysis, to detach them from the parts in a state of more minute division, such as clay, loam, marl, and vegetable and animal matter, and the matter soluble in water. This may be effected in a way sufficiently accurate, by boiling the soil in three or four times its weight of water, and, when broken down and cool, by agitating the parts of the soil in the water, and then letting them rest. In this case, the coarse sand will generally separate in a minute, and the finer in two or three minutes, whilst the minutely divided earthy, animal, or vegetable matter will remain in a state of mechanical suspension for a much longer time; so that by pouring the water from the bottom of the vessel, after one, two, or three minutes, the sand will be principally separated from the other substances, which, with the water containing them, must be poured into a filter, and after the water has passed through, collected, dried, and weighed. The sand must likewise be weighed, and their respective quantities noted down. The water of lixiviation must be preserved, as it will be found

found to contain saline matter, and the soluble animal and vegetable matters, if any exist in the soil.

6. *Examination of the Sand.*—By the process of washing and filtration, the soil is separated into two portions, the most important of which is generally the finely divided matter. A minute analysis of the sand is seldom or never necessary, and its nature may be detected in the same manner as that of the stones or gravel. It is always either siliceous sand, or calcareous sand, or a mixture of both. If it consists wholly of carbonate of lime, it will be rapidly soluble in muriatic acid, with effervescence; but if it consist partly of this substance, and partly of siliceous matter, the respective quantities may be ascertained by weighing the residuum after the action of the acid, which must be applied till the mixture has acquired a sour taste, and has ceased to effervesce. This residuum is the siliceous part: it must be washed, dried, and heated strongly in a crucible; the difference between the weight of it and the weight of the whole, indicates the proportion of calcareous sand.

7. *Examination of the finely divided Matter of Soils, and Mode of detecting mild Lime and Magnesia.*—The finely divided matter of the soil is usually very compound in its nature; it sometimes contains all the four primitive earths of soils, as well as animal and vegetable matter; and to ascertain the proportions of these with tolerable accuracy is the most difficult part of the subject. The first process to be performed, in this part of the analysis, is the exposure of the fine matter of the soil to the action of the muriatic acid. This substance should be poured upon the earthy matter in an evaporating basin, in a quantity equal to twice the weight of the earthy matter; but diluted with double its volume of water. The mixture should be often stirred, and suffered to remain for an hour, or an hour and a half, before it is examined. If any carbonate of lime or magnesia exist in the soil, they will have been dissolved in this time by the acid, which sometimes takes up likewise a little oxyd of iron; but very seldom any alumine.

The fluid should be passed through a filter; the solid matter collected, washed with rain-water, dried at a moderate heat, and weighed. Its loss will denote the quantity of solid matter taken up. The washings must be added to the solution, which, if not sour to the taste, must be made so by the addition of fresh acid, when a little solution of common prussiat of potash and iron must be mixed with the whole. If a blue precipitate occurs, it denotes the presence of oxyd of iron, and the solution of the prussiat must be dropped in till no farther effect is produced. To ascertain the quantity, it must be collected in the same manner as other solid precipitates, and heated red; the result is oxyd of iron, which may be mixed with a little oxyd of manganese. Into the fluid freed from oxyd of iron, a solution of neutralized carbonate of potash must be poured till all the effervescence ceases in it, and till its taste and smell indicate a considerable excess of alkaline salt. The precipitate that falls down is carbonate of lime; it must be collected on the filter, and dried at a heat below that of redness. The remaining fluid must be boiled for a quarter of an hour, when the magnesia, if any exist, will be precipitated from it, combined with carbonic acid, and its quantity is to be ascertained in the same manner as that of the carbonate of lime. If any minute proportion of alumine should, from peculiar circumstances, be dissolved by the acid, it will be found in the precipitate with the carbonate of lime, and it may be separated from it by boiling it for a few minutes with soap-ley, sufficient to cover the solid matter. This substance dissolves alumine, without acting upon carbonate of lime. Should the finely divided soil be

sufficiently calcareous to effervesce very strongly with acids, a very simple method may be adopted for ascertaining the quantity of carbonate of lime, and one sufficiently accurate in all common cases. Carbonate of lime, in all its states, contains a determinate proportion of carbonic acid, *i. e.* about 45 per cent., so that when the quantity of this elastic fluid, given out by any soil during the solution of its calcareous matter in an acid, is known, either in weight or measure, the quantity of carbonate of lime may be easily discovered. When the process by diminution of weight is employed, two parts of the acid and one part of the matter of the soil must be weighed in two separate bottles, and very slowly mixed together, till the effervescence ceases; the difference between their weight, before and after the experiment, denotes the quantity of carbonic acid lost; for every four grains and a half of which, ten grains of carbonate of lime must be estimated. The best method of collecting the carbonic acid, so as to discover its volume, is by the pneumatic apparatus, the construction and application of which are described below. The estimation is, for every ounce measure of carbonic acid, two grains of carbonate of lime. The bulk may be measured by the quantity of water which is displaced.

8. *Mode of ascertaining the Quantity of insoluble finely divided animal and vegetable Matter.*—After the fine calcareous matter of the soil has been acted upon by muriatic acid, the next process is to ascertain the quantity of finely divided insoluble animal and vegetable matter that it contains. This may be done with sufficient precision, by heating it to strong ignition in a crucible over a common fire, till no blackness remains in the mass. It should be often stirred with a metallic wire, so as to expose new surfaces continually to the air: the loss of weight that it undergoes denotes the quantity of the substance that it contains destructible by fire and air. It is not possible, without nice and difficult trials, to ascertain whether this substance is wholly animal or vegetable matter, or a mixture of both. When the smell emitted during the incineration is similar to that of burnt feathers, it is a certain indication of some animal matter, or that which is analogous to it; and a copious blue flame at the time of ignition, almost always denotes a considerable proportion of vegetable matter. In cases when the experiment is needed to be very quickly performed, the destruction of the decomposable substances may be assisted by the agency of nitrate of ammonia, which at the time of ignition may be thrown gradually upon the heated mass in a quantity of twenty grains for every hundred of residual soil. It promotes the dissipation, or affords the principle necessary to the combustion of the animal and vegetable matter, which it causes to be converted into elastic fluids; and it is itself at the same time decomposed and lost.

9. *Mode of separating aluminous and siliceous Matter and Oxyd of Iron.*—The substances remaining after the decomposition and destruction of the vegetable and animal matter, are generally minute particles of earthy matter, containing usually alumine and siliceous matter, with combined oxyd of iron, or of manganese. To separate these from each other, the solid matter should be boiled for two or three hours with sulphuric acid, diluted with four times its weight of water; the quantity of the acid should be regulated by the quantity of solid residuum to be acted upon, allowing for every hundred grains two drachms, or one hundred and twenty grains of acid. The substance remaining after the action of the acid may be considered as siliceous; and it must be separated, and its weight ascertained, after washing and drying in the usual manner.

SOIL.

The alumine and the oxyd of iron and manganese, if they exist, are all dissolved by the sulphuric acid; they may be separated by carbonate of ammonia, which, added to excess, throws down the alumine, and leaves the oxyd of iron in solution, and this substance may be separated from the liquor by boiling, by succinate of ammonia used to excess, which precipitates the oxyd of iron, and by soap-ley, which dissolves the alumina, but not the oxyd of manganese: the weights of the oxyds ascertained after they have been heated to redness, will denote their quantities. Should any magnesia and lime have escaped solution in the muriatic acid, they will be found in the sulphuric acid; this, however, is scarcely ever the case; but the process for detecting them, and ascertaining their quantities, is the same in both instances. The method of analysis by sulphuric acid, is sufficiently precise for all usual experiments; but if very great accuracy be an object, dry carbonate of potash must be employed as the agent, and the residuum of the incineration must be heated red for half an hour, with four times its weight of this substance, in a crucible of silver, or of well-baked porcelain. The mass obtained must be dissolved in muriatic acid, and the solution evaporated till it is nearly solid; distilled water must then be added, by which the oxyd of iron and all the earths, except silex, will be dissolved in combination as muriates. The silex, after the usual process of lixiviation, must be heated red; the other substances may be separated in the same manner as from the muriatic and sulphuric solutions. This process is the one usually employed by chemical philosophers for the analysis of stones.

10. *Mode of discovering soluble, animal, and vegetable Matter, and saline Matter.*—If any saline matter, or soluble, vegetable, or animal matter, is suspected in the soil, it will be found in the water of lixiviation used for separating the sand. This water must be evaporated to dryness in an appropriate dish, at a heat below its boiling point. If the solid matter obtained is of a brown colour, and inflammable, it may be considered as partly vegetable extract. If its smell, when exposed to heat, be strong and fetid, like burnt feathers, it contains animal, mucilaginous, or gelatinous substance; if it be white and transparent, and not destructible by heat, it may be considered as principally saline matter, the nature of which may be known by the proper tests. Nitrate of potash (nitre) or nitrate of lime, is indicated in this saline matter, by its scintillating with burning coal. Sulphate of magnesia may be detected by its bitter taste; and sulphate of potash produces no alteration in solution of carbonate of ammonia, but precipitates solution of muriate of barytes.

11. *Mode of detecting Sulphate of Lime (Gypsum) and Phosphate of Lime in Soils.*—Should sulphate or phosphate of lime be suspected in the entire soil, the detection of them requires a particular process upon it. A given weight of it, 400 grains for instance, must be heated red for half an hour in a crucible, mixed with one-third of powdered charcoal. The mixture must be boiled for a quarter of an hour, in half a pint of water, and the fluid collected through the filter, and exposed for some days to the atmosphere in an open vessel. If any soluble quantity of sulphate of lime (gypsum) existed in the soil, a white precipitate will gradually form in the fluid, and the weight of it will indicate the proportion. Phosphate of lime, if any exist, may be separated from the soil after the process for gypsum. Muriatic acid must be digested upon the soil, in quantity more than sufficient to saturate the soluble earths, the solution must be evaporated, and water poured upon the solid matter. This fluid will dissolve the compounds of earths with the

muriatic acid, and leave the phosphate of lime untouched. It would not, the writer says, fall within his limits to detail any processes for the detection of substances which may be accidentally mixed with the matters of soils. Metallic oxyds and earths of other kinds are, now and then, found in them, but these in too minute quantities to bear any relation to fertility or barrenness, and the search for them would make the analysis much more complicated without rendering it more useful.

12. *Statement of Results and Products.*—When the examination of a soil is completed, the products should be classed, and their quantities added together; and if they nearly equal the original quantity of soil, the analysis may be considered as accurate. It must, however, be noticed, that when phosphate or sulphate of lime are discovered by the independent process just stated, a correction must be made for the general process, by subtracting a sum equal to their weight from the quantity of carbonate of lime obtained by precipitation from the muriatic acid. In arranging the products, the form should be in the order of the experiments by which they were obtained. Thus, 400 grains of a good siliceous sandy soil may be supposed to contain, and have been actually found to contain as follows:

	Grains.
Of water of absorption - - -	18 to 19
Of loose stones and gravel, principally siliceous, -	42 53
Of undecomposed vegetable fibres - - -	10 14
Of fine siliceous sand - - -	200 212
	270 298

Of minutely divided matter separated by filtration, and consisting of

	Grains.
Carbonate of lime - - -	19 to 25
Carbonate of magnesia - - -	3 4
Matter destructible by heat, principally vegetable, -	15 10
Silex - - -	21 40
Alumine - - -	13 32
Oxyd of iron - - -	5 4
Soluble matter, principally sulphate of potash, } common salt, and vegetable extract, - }	3 5
Gypsum - - -	2 3
Phosphate of lime - - -	0 2
	81 125
	298 270

Amount of all the products in the different cases	379 395
Loss - - -	21 5

In one of these instances the loss is supposed small; but in general, in actual experiments, it will be found much greater, as seen in the other, in consequence of the difficulty of collecting the whole quantities of the different precipitates, and the presence of more moisture than is accounted for in the water of absorption, and the loss of it in the different processes. But when it is within thirty or four hundred grains, there is no reason to suspect any want of due precision in the processes.

13. *This general Method of Analysis may in many Cases be much simplified.*—When the experimenter is become acquainted with the use of the different instruments, the properties of the re-agents, and the relation between the external and chemical qualities of soils, he will seldom find it necessary to perform, in any one case, all the processes that have been described. When his soil, for instance, contains no notable propor-

proportion of calcareous matter, the action of the muriatic acid, 7, may be omitted. In examining peat soils, he will principally have to attend to the operation by fire and air, 8; and in the analysis of chalks and loams, he will often be able to admit the experiment by sulphuric acid, 9. In the first trials that are made by persons unacquainted with chemistry, they must not expect much precision of result. Many difficulties will be met with: but in overcoming them, the most useful kind of practical knowledge will be obtained, and nothing is so instructive in experimental science as the detection of mistakes. The correct analyst ought to be well grounded in chemical information; but perhaps there is no better mode of gaining it than that of attempting original investigations. In pursuing his experiments, he will be continually obliged to learn from books the history of the substances he is employing or acting upon; and his theoretical ideas will be more valuable, in being connected with practical operations, and acquired for the purpose of discovery.

Apparatus for the Analysis of Soils.—The necessary apparatus and other conveniences for effecting the above purposes are different: the first consists of a retort in connection with other vessels, so as to form a peculiar pneumatic apparatus, by which the quantity of elastic fluid that is given out during the action of an acid on calcareous soils may be collected and measured, the bulk of it being ascertained by the amount of the water that is displaced. The different parts of the apparatus are these. A bottle or retort for receiving and containing the soil; another containing the acid, furnished with a stop-cock; a tube connected with a flaccid bladder; a bottle for containing the bladder; and a graduated measure. When this contrivance is used, a given quantity of soil is introduced into the first bottle; the second is filled with muriatic acid, diluted with an equal quantity of water, and the stop-cock being closed, is connected with the upper orifice of the first bottle, which is ground to receive it. The tube connected with the flaccid bladder is introduced into the lower orifice of the same bottle, and the bladder, in its flaccid state, placed into the bottle for containing it, which is filled with water. The graduated measure is put under the tube of the bottle for containing the bladder. When the stop-cock of the second bottle is turned, the acid flows into the first, and acts upon the soil; the elastic fluid which is generated passes through the tube connected with the flaccid bladder into the bladder, and displaces a quantity of water in the bottle for containing the bladder equal to it in bulk; and this water flows through the tube of the last bottle into the graduated measure; and gives by its volume the indication of the proportion of carbonic acid disengaged from the soil; for every ounce measure of which two grains of carbonate of lime may be estimated or allowed, as already suggested.

The other things are, an Argand's lamp and stand; funnels for the purpose of filtering; and bottles for containing the different re-agents, as previously noticed.

Another method of deciding in regard to the nature, properties, and qualities of soils, but which is far inferior to that of chemical analysis, though most frequently had recourse to in purchasing of land, is that of attending to the growth and colour of the vegetables which grow upon or cover it; but it requires a sound judgment, much experience, and a correct eye in the execution.

It is customary, also, for farmers to have recourse to other marks in forming their judgments of soils, such as their appearances or colours, and their adhesion, tenacity, or looseness and friability. Thus, the hazel-brown shews a valuable sort of loamy soil, and the reddish sandy mould a good one of the lighter kind. The wetness of lands should like-

wise be well considered, so far as it is connected with the nature of the soil. From the full consideration of all these different circumstances, with a competent experience, a tolerably correct decision may in general be formed in respect to the nature of land. See FARM.

Sir Humphrey Davy, in his "Elements of Agricultural Chemistry," considers it as a vain labour to attempt to class soils with scientific accuracy. He thinks, too, that the distinctions at present adopted by farmers are quite sufficient for the purposes of agriculture; especially if some degree of precision be had recourse to in the application of the terms. The term sandy, he thus conceives, should never be applied to any soil that does not contain at least seven-eighths of sand; sandy soils that effervesce with acids, should be distinguished by the name of calcareous sandy soil, to distinguish them from those that are siliceous. The term clayey soil should not be made use of to any land which contains less than one-sixth of impalpable earthy matter, not considerably effervescing with acids: the word loam should be limited to soils containing at least one-third of impalpable earthy matter, copiously effervescing with acids. A soil to be considered as peaty, should contain at least one-half of vegetable earthy matter. And that, in cases when the earthy part of a soil obviously consists of the decomposed matter of one particular sort of rock, a name derived from the rock may with propriety, it is supposed, be given to it. In this way it is imagined, that if a fine red earth be found immediately above decomposing basalt, it may be denominated basaltic soil. If fragments of quartz and mica be found abundant in the materials of the soil, as is often the case, it may be called granitic soil; and the same thing may be done in a great number of other similar cases.

It is evident, that the greater precision and correctness there are in this business, the greater will be the advantages of the cultivators of the land or soil.

Division of Soils.

Kinds.

1. Clayey,
2. Loamy,
3. Chalky,
4. Gravelly,
5. Sandy,
6. Peaty or mossy,
7. Boggy and heathy, or
8. Moory,

However, these several divisions must evidently be capable of being subdivided under various other heads, according to the differences in the constituent ingredients.

Clayey Soils.—It may be remarked, that as clay is seldom found in any thing near a state of purity in soils, it is plain that there must be much difference in the soils in which it is the chief constituent principle, according to the proportion and nature of the admixture that has taken place. These soils are mostly found to contain an intermixture of different earthy materials, with various animal, vegetable, and mineral substances, and often blended with considerable quantities of siliceous and sandy matters. It has been observed, in a late practical work, on the authority of Dr. Anderson, that it is upon this account that the clayey soils of some districts are so abundantly fruitful and productive, while those of others are insuperably sterile and refractory. Farmers, or those engaged in cultivating land, for the most part being only acquainted or conversant with earth or mould, as it offers itself to their attention in the gross or whole, have not, he thinks, been led to remark the astonishing diversity that takes place in respect to the properties of clays and other

other bodies that are united with them as primitive and constituent parts of soils, in their original and native states; but having found that they all agreed in possessing the property of imbibing and retaining moisture, and thereby of becoming soft and ductile, have, probably too hastily, concluded them to have in some measure a similarity in their other qualities. In this way erroneous notions have frequently, he supposes, been engendered respecting soils in which these substances abound. For it is well ascertained, from the use of clays in slates of greater purity, that there are essential differences in their qualities. There are some sorts, as that which is denominated fuller's-earth, and several of the soft boles that have the cohesive property in but a very slight degree; while others, such as those which are termed *tills*, are so extremely tenacious and viscid, as to be capable of being drawn out into threads: and there are still others, which, from their softness, and property of imbibing water readily, are capable of being cut with great facility by any sharp instrument; while some other sorts are so firm, hard, and compact, as scarcely to admit of being softened by means of water. The clays which are employed for making the finest porcelain, and those used in the composition of the more coarse wares, are only to be met with in particular situations and districts. This fully shews that much diversity must exist in the nature of soils of this description, and which are perhaps far from being yet fully understood or ascertained. But, besides soils of this sort differing in these respects, they have an equal diversity in their appearances or colours, and their textures; being found in the state of nature of very different colours, as red, white, blue, and yellow, and of very different degrees of compactness or density; in some cases readily admitting the intermixture of other matters to improve them; while in others they are highly refractory in this respect, being with very great difficulty made to unite with them. It is plain, therefore, that in the first of these varieties of clayey soils, the proportion of siliceous or sandy material must be considerably larger than in the latter, in relation to that of the clayey part. But notwithstanding the above, all these descriptions of soils are found to possess some degree or other of the stiff or heavy quality, according to which, with proper attention to their other circumstances, their cultivation and improvement must be conducted and carried on.

The chemical analysis of different sorts of clays, executed by the late ingenious Mr. Somerville, and detailed in his valuable Survey of East Lothian, serves to place the nature of such soils in a clear point of view.

The intelligent writer concludes, that the experiments which he has described seem to prove, that the principal constituent parts of fertile clays are alkaline salts, calcareous earth, and oil, together with a very small proportion of iron. In the strongest and most retentive clays, the proportion of oil is greater, and that of alkaline salt and calcareous earth less, than in such as approach nearer to the nature of loam; except in the experiments, when the clay was taken from the top of a lime-rock, in which it was found to contain less oil than any of the others, and more calcareous earth than either loam or any of the other clays: it differs further in containing no iron. And it is supposed that *tills* (*i. e.* a name given in East Lothian to such of the thin clays as are blue, yellow, and red coloured, and, at the same time, barren) contain the same principles as other clays, with the exception of calcareous earth, of which they appear to be entirely destitute; in place of which, they contain a very great proportion of iron, which seems to be the principal cause of their barrenness; and, according as they contain more or less of it, they are more or less sterile.

But in whatever manner these soils may be constituted, they invariably require greater power, labour, and attention, to bring them into a condition proper for the purposes of the farmer, than those of most other sorts. They are, in fact, naturally sterile, from their adhering together in masses; unless where the summer is so divided between rain and sun-shine, that they are kept in a medium between drought and wetness, a circumstance that rarely happens in this uncertain climate. Where the seasons are wet, the plants growing on such soils are inundated; the closeness of the clay not admitting the water to soak into the ground: and in a dry season the ground becomes so solid, that the roots of plants cannot penetrate or spread themselves in it. A tolerably accurate idea of the fertility or barrenness of clayey soils may be obtained, by regarding the appearance of the different plants, as they vegetate: if they appear lively and vigorous, a favourable opinion may be drawn; the reverse, of course, follows, if they appear languid, unhealthy, and stunted in their growth.

However, the clayey soils are thought to contain more of the food of plants than almost any other; as, without much alteration, such lands will produce good crops of grass, provided care be taken not to feed them too closely, nor to admit cattle into them in the spring. In order, however, to bring them into tillage, it is necessary that such soils should be altered by the admixture of such substances as tend to open the soil, and to break the cohesion of its particles, and which supply vegetable matter in many cases. When once these objects are accomplished, the land will become highly valuable, retaining manure excellently, and never returning to its former state of barrenness. These sorts of soils are consequently capable of much improvement, by the judicious application of substances and manures of suitable kinds, and a proper course of tillage husbandry. And in regard to the former, pounded limestone, gravel, sand, and calcareous marl, are the most useful articles in the view of altering the texture; and the best season for laying them on is in the beginning of the year, as it is only during winter, while the surface is frozen, that teams can stir upon them. Where those fossil substances cannot be procured, and the vegetable principle is deficient, a mixture of dung and sand, especially that from the sea-shores, will contribute greatly to fertilize the ground. But the application of lime alone has, in many instances, been attended with great advantage; though some farmers disapprove of it, on account of its being apt to cake, and not mixing intimately with the soil. However, a variety of other substances may likewise be employed, in cases where a deficiency of those fossils exist, such as composts of chalk and dung, tanners' bark, sea-mud, and other materials that promote a strong fermentation: and it has been found by experience, that chalk and these together not only enrich the soil, but also make it produce earlier crops than it did before. The chalk, indeed, thus laid upon the land at length subsides, settles as deep as the plough goes, and is then of no further value in opening the land; but it may be recovered and brought up again to the surface, by ploughing somewhat deeper than ordinary, after which it will produce its former good effects. Gravel from neighbouring soils may also be carted upon clayey soils, to which may be added sea or pit-coal ashes, dust from saw-pits, chips, and rubbish from the back yards of houses, straw, and stubble, rotten wood, burnt clay, peat ashes, and perhaps *gypsum*, or plaster of Paris in some cases. This last substance, as well as those of lime and other calcareous matters, may also be found useful in such soils of this sort as have a sour tendency, by neutralizing and correcting such acidity, by which they may

may be rendered more proper for the growth of crops of both the grain and grafs kind.

And it has been observed in the third volume of the Farmer's Magazine, that the thinner kinds of these lands are almost univerfally poor: the colder and more unkindly bottoms fuch foils are found upon muft naturally render them fo. And that fuch land is badly adapted to bear much fatigue of the plough, either in winter or fummer: that being the cafe, neither autumn nor late fpring ploughing can be depended on by the farmers; the land being fo delicate of itfelf, it cannot refift the alternate froft and rain in winter; and if it happen to be a wet feafon before feed-time, the profpect of a crop muft be very unpromifing; and by the latter, if drought come on, it cannot fail of penetrating to the bottom of the furrow; in which cafe, the grain caft upon it muft remain deftitute of nourifhment: therefore, the moft proper feafon for ploughing fuch land is February, and the beginning of March, when the weather is dry. And further, that the ftronger forts baffle the operation of the plough more than any other it encounters. The only friend that co-operates with it, in fubduing fuch foils, is ftrong liming: without doubt, winter froft is alfo of much benefit; on which account, the farmer is often induced to plough fuch land early. But it ought to be remembered, that although falutary effects may be produced by early ploughing, when there happens to be much froft; yet very pernicious effects muft follow, when the winter turns out to be very wet: for it is generally understood that clayey foils, for the moft part, lie upon a retentive bottom of the fame nature; therefore, all the water that falls upon them muft eafily penetrate to the bottom, through the feams between the furrows: and as the fubfoil, or bottom of the furrow, will be left with a fmall bank on the land-fide of the coulter cut together, with the under arafe of the back part of the furrow refting upon it, the water muft be prevented from running to the drain-furrow, which will prove very pernicious and hurtful to the foil, being too cold at the bottom, in its beft ftate. It may perhaps be faid, that the fame danger will be incurred, at whatever period the ploughing is performed; but there is a material difference between water ftagnating in the bottom of the furrows for four or five months, and when it only does fo for as many weeks: therefore, wherever autumn or early winter ploughing is praftifed on fuch foils, that of fummer fallow will alfo, he thinks, be often neceffary.

It may be noticed, that the moft proper forts of crops, in the firft fort, are peafe and oats; and where compolls can be had, and applied to the fward, fummer fallow will be beneficial; followed by wheat and artificial graffes: and in the latter, cabbages, wheat, beans, peafe, and grafs-feeds for both hay and palture. See *CLAYEY Land*.

Almost every one of the above modes of improving and bettering the qualities of clayey foils are praftifed with much advantage and fuccefs, in one or other of the different places throughout the country where they are met with. In the northern parts, however, where the ufe of lime on thefe forts of foils, efppecially the better cultivated kinds of them, is more had recourfe to than in the fouthern, they not uncommonly apply farm-yard manure the fame feafon in which the land is limed, though not, by any means, in combination with it; as by this praftice the lime is believed to act more powerfully, as well as more effectually, and with far greater expedition, than when it is employed in the manner of compoft, or mixture with earthy matters. It has been fully fhewn that lime, in its active ftate, has great power in promoting the folution and decay of all vegetable matters in foils, and, of courfe, of greatly increafing the

proportion of that fort of material in them. In this way its readinefs in producing this fort of matter in a large quantity, when applied to foils which contain a confiderable portion of vegetable materials, is eafily explained. And the powers of improving different kinds of clayey foils, in thefe methods, may be very much aided and affifted by well directed modes of ftirring and tilling fuch lands; as where the ploughings, harrowings, and other proceffes on them, efppecially in the more ftiff and retentive kinds, are frequent, and made at feafons of the year in which they are neither too dry and cloddy, nor too wet and poachy, fo that they may be well broken down and reduced in their parts, and fully expofed to the influence of the atmosphere. In thefe ways they are enabled to acquire a high degree of pulverization and finenefs in their particles, by which the growth of plants upon them is greatly forwarded, and rendered more perfect. The feed is here to be covered in, for the moft part, in a complete manner; the previous ploughings having been made to fuitable depths, as the circumftances of the lands may direct. On the thinner forts, where fprings are apt to rife, they fhould have lefs depth than in other cafes. The tools and teams employed in working them fhould be ftrong, and fo attached as to do as little injury by poaching as poffible; fuch feafons as are neither too moift nor too dry being, in all cafes, chofen for the purpofe.

Soils of this nature prevail very greatly in many diftricts of the kingdom; and though they are improved, and brought into proper order for cultivation, with great difficulty, labour, and expence, they commonly anfwer very well in the end, by affording a long continued and very abundant produce.

2. *Loamy Soils*.—It is evident that loam, in its natural ftate, is a fort of earthy material, more compact than chalk, but lefs cohesive than clay. In thefe foils there is likewise much variety; fome being ftiff and compact; while others are more open, loofe, and porous: hence we have heavy, ftiff, and light loams. The materials of which thefe foils are chiefly compofed are thofe of the clayey, chalky, fandy, and gravelly kinds; on which account writers on husbandry have denominated them clayey loams, chalky loams, fandy loams, and gravelly loams; and fometimes, where a fmall portion of the oxyd or calx of iron is found mixed with the loamy material, they are termed *tilly* loams. The firft, according to Kirwan, denotes a compound foil, moderately cohesive, in which the argillaceous ingredient predominates. Its cohesion is, then, greater than that of any other loam, but lefs than that of pure clay. The other ingredient is a coarfe fand, with or without a fmall mixture of the calcareous ingredient. It is this which farmers generally call ftrong, ftiff, cold, and heavy loam, in proportion as the clay abounds with it. And the fecond indicates a loam formed of clay, coarfe fand, and chalk; in which, however, the calcareous ingredient or chalk much predominates. It is lefs cohesive than clayey loams.

The third fort denotes a loam in which fand predominates: it is lefs coherent than either of the above-mentioned. Sand, partly coarfe and partly fine, forms from 80 to 90 *per cent.* of this compound. The fourth differs from the above only in containing a larger mixture of coarfe fand, or pebbles. This and the two laft are generally called by farmers light or hungry foils; particularly when they have but little depth. The fifth is generally of a dark brown or reddifh colour, and much harder than any of the preceding: it confifts of clay and the calces of iron, more or lefs intimately mixed. It may be diftinguifhed not only by its colour, but alfo by its fuperior weight; it fometimes effervesces with acids, and fometimes not; when it does,
much

much of the iron part may be separated, by pouring it, when well dried, into spirit of salt; from which the iron may afterwards be separated by alkalis or chalk. And akin to this are certain vitriolic soils, which, when steeped in water, impart to it the power of reddening syrup of violets. These are generally of a blue colour, but redden when heated.

Further, it has been remarked by a late writer, that in proportion as the clayey principle disappears, they recede from soils of that kind, and that of course the nearer the quality of the clayey matter comes to that of the others, the stronger and heavier the loamy soils must be. And that the differences in the lightness and friability of the soils of this class, in a great measure, depend on the relative proportions of the other ingredients. Where the calcareous ingredient greatly exceeds those of the sandy or gravelly kinds, they are neither so light nor so pulverizable as where they are nearly equal, or where the sandy or gravelly matters considerably predominate over it. In the latter case, indeed, such soils are formed as have been denominated by practical farmers light and hungry, especially where the earthy bed or stratum thus produced is but of little depth, and rests on a gravelly or flinty bottom or sub-soil. It is also added, that the variety in the colours of soils of the loamy kind, seems, in some instances, to be produced by the union or mixture of metallic substances in greater or less proportions, and in more close or more lax states of combination with them; in others, by the prevalence of acid impregnations. The colour in the first case is for the most part reddish, approaching to brown; in the latter it is commonly blueish, changing by heat to a slight red. But these are not, he supposes, the only causes that influence the colour of these soils; they are much altered in their appearances, as well as other qualities, by the different proportions of vegetable or animal matter which they contain, and the different states of decomposition and decay to which they have been carried by length of time, cultivation, and other means. In situations, it is said, where this sort of soil has been but little disturbed, and consequently little changed by the artificial additions of either animal or vegetable substances, and those which it naturally contained not having advanced to the stage of perfect solution and decay, it is generally found of a light brown or hazel colour; but where much culture has been employed for a length of time, and large applications of animal and vegetable matters frequently made, the natural and artificial materials of these kinds, having proceeded more nearly to the state of perfect dissolution and destruction, it has an appearance that approaches to that of black. And it is added, that from these various circumstances, the properties of the soils are likewise considerably altered and affected. Such soils of this kind as are met with in extensive tracts on the borders of the sea, and of large rivers communicating with it, are generally rich and fertile, being mostly composed of a fine sort of sand, calcareous matter in a high state of tenuity from the attrition or rubbing down of different kinds of shells and other marine productions, and a rich matter proceeding from the dissolution of various luxuriant sea plants, and innumerable sorts of animal exuviae. These alluvial materials being all gradually deposited and incorporated with the natural loamy earth of the situations in which they are found.

There are soils of this sort, in particular situations near the sea-coasts, which are extremely rich, being a great deal constituted or composed of layers of oyster and cockle-shells, in combination with their earthy matters, and much impregnated with marine salt from the overflowings of the sea, which seems to have been highly beneficial to them, when

acted upon, for some length of time, by the air of the atmosphere, in the production of grain as well as other crops. In these cases, this saline quality would appear to be entangled in a peculiar sort of loamy substance, very different from any which are met with in upland situations. The richest loamy soils in such places are mostly composed, in a great measure, of sand in mixture with a portion of clay, and are, from this quantity of sand, very friable in their nature. But with the soils in these particular cases, it is very different; as whatever degree of friability they may possess, seems to arise from the fermentative power, which is caused by the action of the atmosphere on substances that abound with mucilaginous matters. They fall, it is said, when exposed to the changes of the weather, into dies, and are more like the crystallized forms of mud drying in the sun, than the crumbling looseness of common loams. There is very little appearance of any sand in them; the particles of which they are composed are so very fine, that it would be readily imagined, they would easily become an impalpable powder; but, on the contrary, they are capable of such adhesion, that a clod will often become very hard. Consequently they appear to be composed of clay, very fine sand, a mucilaginous principle which ferments with rain and warmth, and the saline quality which is derived from their origin and peculiarity of situation. When crumbled in the hand, they yield a strong scent, so that the volatile alkali would probably be discovered by chemical trials, it is thought, in them. Soils of this loamy kind are met with in Foulness island, in Essex, and some other similar situations. Their natural fertility is often so very great, that the farmers are but little attentive to manure; nor is it commonly ventured for any sort of grain, as it throws up too much straw, without increasing the quantity of corn. It might, however, probably be applied for beans, or cabbages, where they were the previous crops, with much advantage.

This sort of excellent loam is supposed utterly incapable of being formed or attained by any kind of artificial means: the great elaboratory of nature in this, as in so many other cases, leaves, it is thought, the utmost skill of the chemical farmer at a vast distance.

The chemical analysis of this sort of soil, as given in the work already mentioned, by Mr. Somerville, may shew still more fully the properties which are possessed by this kind of land.

From the experiments of this ingenious writer it would appear, that the principal constituent parts of the different kinds of loam, upon which they were tried, are vegetable and calcareous earths, oil, alkaline salts, and an inconsiderable quantity of iron. The deep black loams seem to contain considerably more oil than any of the other two, but less alkali and calcareous earth; which, in some measure, accounts for the inactive nature of some soils of that description, which, by no means, yield crops equal to what might be expected from their appearance. The hazel-coloured loam contains less oil than the black, but a greater proportion of alkaline salts and calcareous earth; owing to which, all the loams of that description in East Lothian are more active, and produce better crops than the former. The light loams, from the circumstance of their containing less oily and more alkaline and calcareous matter, are the most active, and are commonly termed *barp* lands, by the farmers in that district.

Further, these soils being, in general, less tenacious or more friable and mellow than clays, are capable of being more easily improved with less expence and labour of team, and also at any season of the year. The manure proper for such soils varies according to their relative degree of fertility,

tility, and the greater or less proportion of acidity and of argillaceous and calcareous matter they contain. Those loams which are contiguous to the banks of rivers, or the sea-coast, are generally admitted, as has been seen, to be fertile, as to require little additional aid from manure; but for the more heavy and adhesive kinds, a compost of effete lime and dung, or lime in combination with pulverized or ground bones and blood, or other animal recrements, and such terrene substances as contain large quantities of sand, may be beneficially applied in such quantities as the tenacity or poverty of the land may require. Where the argillaceous principle abounds, lime alone may be spread on the soil, in order to counteract the acidity prevalent in such soils; in the contrary case, or where there is an abundance of sand, gravelly, or chalky particles duly mixed with the loams, well rotted dung, vegetable manures of different kinds, and the mud or deposition procured from stagnant waters, may be spread to the greatest advantage; and in case the loam be too friable or light, a quantity of clayey loam may be carried on the land, sufficient to impart a proper degree of cohesion or tenacity.

In the county of Oxford they find lime useful on the yellow loams which are wet and stand in need of draining. They are rarely soils of much natural fertility; but lime makes them very productive in oats, and prepares them for future wheat crops; when employed in the quantity of from twenty to thirty quarters *per* acre. It answers greatly, likewise, on the red loamy sand lands in the proportion of from fifteen to twenty-five quarters on the acre.

In Suffex, wherever the land or soil tends to a reddish loam, or inclines to be sandy, they have recourse to marle, which is of a soapy nature, with great success. They employ it in the quantity of from ten to twenty waggon-loads on the acre, which is from eight hundred to sixteen hundred bushels; applying it in the autumnal or winter seasons.

Where a soil deficient in calcareous matter contains much *soluble* vegetable manure, as is the case in some soils of this kind, the application of quicklime to them should always, according to the writer of the work on Agricultural Chemistry, be avoided, as it either tends to decompose the soluble matters by uniting to their carbon and oxygen, so as to become mild lime, or it combines with the soluble matters themselves, and forms compounds having less attraction for water than the pure vegetable substance. And the case is the same in regard to most animal manures, when in such soils; but the operation of the lime is different in different cases, and depends upon the nature of the animal matter. With oily matters lime forms a kind of insoluble soap, and then gradually decomposes them by separating from them oxygen and carbon. It combines likewise with the animal acids, and probably, it is said, assists their decomposition by abstracting carbonaceous matter from them combined with oxygen; and consequently it must render them less nutritive. It tends also to diminish the nutritive powers of albumen from the same causes; and always destroys, to a certain extent, the efficacy of animal manures, either by combining with certain of their elements, or by giving them new arrangements. Lime should, of course, never be applied with animal manures to soils, unless they are too rich, or for the purpose of preventing noxious effluvia. It is injurious when applied in mixture with any common dung to soils, and tends to render the extractive matter of the dung insoluble. But lime is constantly efficacious in all those cases in which fermentation is useful to produce nutriment from vegetable substances in soils.

All the soils of this nature are capable of affording almost

all sorts of crops, both those of the grain and root kind, as well as those of the pulse, hemp, and flax sort, as may be seen under these different kinds of crops.

The modes of cropping in some districts follow, in some measure, the qualities of the loams, whether they be strong, fertile, impalpable, sandy, or of any other kinds or descriptions. The medium fertile loams are probably, however, on the whole, the most suited to every sort of farming purpose.

3. *Chalky Soils.*—All these are soils, which are found to occupy very extensive tracts in many of the southern districts of the kingdom, as well as in some of the more northern; and, like those which have been already noticed, differ very materially both from the diversity of the calcareous material which they contain, its proportion, and the other matters that are intermixed and blended with it, as well as the thickness of the earthy bed on which it rests, and the nature of the inferior stratum on which the whole is deposited. It has been stated by an useful practical writer, that matter of the calcareous kind is contained in many different stony substances, besides that of chalk, as marble, limestone, coral, and shells of different kinds; and in states of union with other materials, such as sand, the different simple earthy bodies, in different proportions, and in some instances with iron and magnesia. Its capability or power of imbibing and retaining moisture is considerable, though not so great as that of clay. It burns to lime by proper degrees of heat, and absorbs carbonic acid gas or fixed air in different proportions from the atmosphere, and returns again to the state of chalk or effete calcareous matter. It is found of very different degrees of hardness and friability, as well as of different states of fineness or pulverization, in different soils of the class to which it belongs. It varies also greatly in its effects in respect to vegetation; from the different matters that may happen to be combined with it in its primitive or original state. And it is further stated, that it has long been known to the practical farmer, that some sorts of lime or calcareous matter may be employed in large proportions; while others cannot be used, except in very small quantities, without doing very considerable injury to the soil with which they are incorporated. But that the long unexplored cause of this diversity of effect in different limes, or calcareous matters, seems lately to have been placed in a more clear and satisfactory point of view, by the experimental attempts of an ingenious philosopher, Mr. Tennant, who has found by repeated experiments, that that sort of lime which is the most friendly to vegetation, consists entirely of calcareous earth, and quickly absorbs a large portion of carbonic acid gas or fixed air from the atmosphere; while that which is injurious and unfriendly to the growth of plants, contains only three parts of pure calcareous earth, the other two consisting of magnesia; and that it absorbs comparatively but an extremely small portion of carbonic acid gas or fixed air from the surrounding atmosphere. It was also found, that this kind of mixture of calcareous matter was very slow in acquiring the power of supporting vegetation, even after it had been converted into lime, and remained for a considerable length of time in the state of mortar. And that the limestone in which there is a mixture of magnesia, is much harder, and dissolves considerably more slowly in acids, than that which is purely calcareous. It is likewise supposed, that the crystallized structure commonly observed in the magnesian limestone indicates, that it has not been formed by the accidental conjunction of the two earths, but constituted by their chemical union. The difficulty with which it is dissolved by

means of acids, may also, it is conceived, in some measure, depend on the attraction of its different component particles to each other. It is a sort of limestone, which is found to extend itself over very large districts in the midland parts of the island, as well as in the more northern counties, as is obvious from the practical distinctions of *mild* and *hot* limes, which are in common use, as noticed by doctor Fenwick, in his excellent Essay on Calcareous Manures.

It has indeed been suggested, that these interesting facts not only shew, that whatever sameness there may be in the nature of calcareous matter, when in its pure and unadulterated state, but that, as met with in soils, and different substances of the calcareous kinds, it has considerable diversity, and when in union with magnesia, it is in a high degree prejudicial to the growth of vegetables. Later trials have, however, rendered this last supposition somewhat doubtful; therefore, until further experiments have more completely cleared up the matter, the farmer should proceed with caution in the use of such materials. But though magnesian lime or earth in its caustic state may be injurious to vegetation, such lime, in ordinary circumstances, is not unfrequently made use of in moderate quantities upon soils of the fertile kind, in the counties of Leicester, Derby, and York, with good effect, and is capable of being employed in larger portions on soils containing more full supplies of vegetable matter. Magnesia, when combined with carbonic acid gas, seems not, it is said, to be hurtful to the growth of plants, and in soils rich in manure, it is soon supplied with this principle, from the decomposition of that substance.

In explanation of the above, sir H. Davy has stated, that magnesia has a much weaker attraction for carbonic acid than lime, and will remain in the state of caustic or calcined magnesia for many months, though exposed to the air; and that as long as any caustic lime remains, the magnesia cannot be combined with carbonic acid, for lime instantly attracts carbonic acid from it. When a magnesian limestone is burnt, the magnesia is deprived of carbonic acid much sooner than the lime; and if there be not much vegetable or animal matter in the soil to supply by its decomposition carbonic acid, the magnesia will remain for a long while in the caustic state; and in such, acts as a poison to certain vegetables. And that more magnesian lime may be used upon rich soils, than those of other kinds, seems to be owing to the circumstance, that the decomposition of the manure in them supplies carbonic acid. And magnesia, when mild or fully combined with carbonic acid, seems to be constantly an useful constituent part of soils. Carbonate of magnesia, produced by boiling the solution of magnesia in supercarbonate of potassa, has been thrown over grass, and upon growing wheat and barley, so as to render the surface white, without injuring the vegetation in the smallest degree, by the same experimenter. Some most fertile districts are also said to contain mild magnesian earth, as the Lizard, in Cornwall.

This explanation has been somewhat confirmed by mixing and using four portions of the same sort of soil in this manner: with one-twentieth of its weight of caustic magnesia, with another the same quantity of magnesia and a proportion of fat decomposing peat, one-fourth of the weight of the soil; one portion was left in its natural state, and one mixed with peat without magnesia. They were made towards the end of the year, and sown in the early spring the next, all of them with barley; which grew very well, it is said, in the pure soil; but better in the soil containing the peat and magnesia; and nearly as well in the soil with the

peat alone; but in the soil mixed with magnesia alone, it rose very feebly, and looked yellow and sickly. The repetition of this trial was attended with similar results; and it was found, that the magnesia in the soil mixed with peat became strongly effervescent, while the portion in the unmixed soil gave carbonic acid in much smaller quantities. In the one case, it is supposed, the magnesia had assisted in the formation of manure, and had become mild; in the other case it had acted as a poison on the plants.

It has also been found, that matter of the calcareous kind, whether effete or in the state of carbonate, or in the more active one of causticity, as quicklime, seems ultimately to promote the resolution and destruction of all vegetable and animal substances; but that in the latter state, it acts with much greater violence on these materials, destroying their organization, and dissipating their principles more quickly, as well as robbing them more completely of the carbonic acid gas or fixed air, which is so essential; while in the former it operates with great mildness, and only aids the resolution of those substances, by gently promoting the process of putrefaction or decay.

It must be obvious, that in them the proportions of clayey, loamy, and gravelly ingredients, in combination with the calcareous matters of these soils, are materially different in different districts: where the clayey and loamy are comparatively in large quantities, the heavier kinds of chalky soils are met with; but where the sandy or gravelly are prevalent, the lighter ones. Material differences also arise from the earthy matter with which the calcareous substance is blended in the state of soil, as where the quantity of this is small, and not reduced into any perfect state of mould, the soil is poor and thin; but where the thickness of this superficial bed or layer is considerable, and the animal, vegetable, or other substances of which it is constituted, have proceeded to a more complete stage of decomposition, the soils are more rich and heavy. Where the state of the sub-soil is of a compact nature, and much blended with siliceous or stony matter, or has a mortary hardness, it is less favourable than where it is of a more open, brittle, or mellow powdery nature. From the calcareous material being abundant in these cases, the principal intention is the changing of their textures, and the supplying of vegetable matter to them.

And it is found, that in the thinner or lighter calcareous soils, clay, or clayey marl, and the vegetable recrements deposited and obtained in wet or swampy situations, may be beneficially applied. In those of a contrary or heavier nature, the spreading of sandy or clayey loams, as circumstances may require, on them, will be attended with advantage, as altering their texture; and to these may be added composts of various vegetable and animal substances, farm-yard manure and ashes; besides which great attention is requisite in breaking up these soils at the proper season, as, if this operation be deferred till a dry season, they become so bound or hard, that it will be impossible to work them, until they are softened by rain, without very great expence both of teams and of labour in other ways. Near London, the use of foot and malt-dust has also been found highly beneficial in many cases of these kinds of soils.

Soils of this nature work, and are capable of being improved very differently, according as they are more or less heavy. The light and mouldering chalky lands readily admit of these means of amelioration, while those which are of a more heavy and solid quality, allow of them with considerable difficulty and trouble. Some sorts of crops are in a great measure peculiar to these sorts of soils, as those

of faintfoin, and some others, but they are capable of bearing most kinds in their different qualities and states. See *STONEBRASH Land*.

Soils of this kind, though they have a barren and unpromising appearance, are sometimes very productive.

4. *Gravelly Soils*.—It may be noticed, that in the gravelly materials, which constitute soils of this description, there is much difference in the size of the stony particles, from that of the smallest pea, to that of the egg of a pullet. But when they become of still larger dimensions, they are denominated stony or rocky soils, according as they are in detached or connected masses. But the gravelly beds, of whatever kind, consist in general of siliceous or flinty, or those of the calcareous or chalky kinds, while the rocky and stony substances are of several different qualities. Various other matters are mixed with these, so as to constitute soils of this kind, which have much diversity in different respects. These are principally matters of the loamy or earthy kind, arising from the putrefaction and decay of different animal and vegetable materials. It is also remarked, that the gravelly mixture is sometimes found to approach nearly to the surface, while at others it recedes considerably from it. In Middlesex, Mr. Middleton found, that when the stratum was very near the top, a full crop of yellow blossomed broom covered the ground; if in a state of grass, and when ploughed, an equally full crop of forrel. This was seen in the old inclosures. In some instances springs arise immediately underneath; in others they are at a great depth. The bottom or sub-soil is likewise various; in some cases it is stony and rocky, in others it is clayey, or a rocky gravel, and sometimes sand, &c. And it is added, that the open porous nature of gravelly soils disposes them to admit moisture very readily, as well as to part with it with equal facility; from the latter of which circumstances they are subject to burn, as it is termed, in dry seasons, which is not the case in the heavier or more retentive sort of soils.

It is evident that the differences of these soils must be remedied according to their nature, by the use of different sorts of matters of the marle kind. In cases where the gravel is of the calcareous kind, clay, or clayey loam, may be properly employed; and a mixture of the carbonate of lime, or lime in its effete state, and clay, may be found beneficial; also chalk, as being of the same nature, may be made use of in the same way. For these kinds of gravel, which, from their contiguity to springs, are apt to lie wet in the winter, there is no manure more properly adapted than chalk; which, although it does not abound with vegetable matters in any large proportion, like yard-dung, and some other dressings, is, however, an excellent preparation for them, and will, in some measure, supply the place of such substances. It is found, from its absorbent nature, to have a good effect, not only in counteracting the superabundant moisture of such soils, but in lessening their heat; by which means the disposition to burn in the summer, so inimical to the growth of various crops, and to which all gravels are in some degree liable, is prevented: and in this last view, chalk, though particularly adapted to those of the wet and springy kind, may be applied with success on gravels of almost every denomination, with the prospect of advantage. Where there exists any deficiency in the vegetable and animal earthy materials, it may be properly supplied by dung of the farm-yard kind in its more reduced state, and various other animal excrementitious matters, which may probably be employed with the greatest benefit in the form of composts, with good loamy mould, ashes, the mucilaginous and clayey depositions of rivers and ponds, and other sub-

stances of a similar kind. Several of these materials, and some others of the animal class, are, however, often used separately to the surface of soils of this sort, with the most evident advantage.

Also much benefit may be derived to such lands by a proper alteration of green vegetables, and other crops that are usually grown upon them; as by such means the moisture is more preserved, and the soils more guarded against injury. In the Agricultural Survey of Hertfordshire, Mr. Young speaks of a poor sort of gravelly soil, the characteristics of which are wetness, or spewiness, as the farmer terms it, from many springs; most of which are sulphury, and extremely unfriendly to vegetation, abounding more or less with smooth blue pebbles, which, at various depths, are conglomerated by sulphury clay into plum-pudding stones; in some places so near the surface as to impede the plough, if set but for an inch or two at a greater depth than the old scratchings of bad ploughmen: it is stiff, without a matrix for the roots of plants; and sharp and burning even in the immediate vicinity of springs: it has much sticky clay in the composition, but of a most sterile nature. He hollow-drained many acres; but as he was obliged to employ the pick-axe, the expence was too great; and he found that the ploughing it into high ridges was considerably the best way of draining it. When it has been drained, manures have then a great effect for a time; but such was the voracity of the soil, that the benefit of manuring was soon lost, even when it had been laid down for pasture some years, as a preparation for corn; the best improvement that can, he supposes, be made on it, when cultivated for such a purpose. But it is suggested by Mr. Walker, that this soil is best adapted to wood; for he was surpris'd to see the hedges thriving with great luxuriance on land not worth cultivation.

Lime, in mixture with good mould, has been found useful in Oxfordshire, on hot gravelly land. It does very well alone, but not equal to where it is employed in combination with some sort of earthy material. In the lighter kinds of gravels, the clayey marles are also frequently of very great utility; and in those of the heavier description, the calcareous sort may often be employed with equal benefit. When well mixed up, and blended with different earthy materials, they may both be laid upon gravelly soils with the best effects, in many cases.

By these different means of improving the textures and qualities of these kinds of soils, they have been so much altered and amended in the nature and arrangement of their parts, as to be capable of affording good crops of many different sorts, as well as of enduring the summer heats, without being subject to become too dry or burnt up by them.

5. *Sandy Soils*.—It is stated that these are a description of soils, which seem to have been formed gradually by the reduction of different sorts of hard bodies in nature, particularly those of the calcareous, siliceous, and stony sorts, the particles being brought into different states of fineness, being in some cases extremely minute. They vary equally in their colours in different instances, being sometimes perfectly white, brownish, yellow, and red. The differences in the quantities in which other sorts of matter enter into their compositions, afford considerable variety in their weights, tenacity, and different other properties. In some districts, soils of this sort exist of different kinds, from the lightest species of loam to the naked sand composed entirely of small flints, and in all of them there is a mixture of earth; according to the proportion of which, they are more or less favourable to vegetation.

And it has been remarked by the late Mr. Somerville, that, in East Lothian, the whole of the sandy soil is evidently superinduced, or placed upon the land; the bottom upon which it is laid being uniformly of the same quality with the circumjacent grounds. The origin of this sand, which is accumulated upon several parts of the coast, is owing, it is supposed, to two causes: the first, and that which no doubt has produced the greatest part of it, has been the washing away of many points of land by the sea, by which the coast, formerly very much indented, is now rendered pretty uniform, and brought nearer to a regular figure: the second cause of its formation has arisen from the washing of the soil in the interior, during heavy falls of rain, by which great quantities have been brought from the higher grounds, and either deposited in places where the current has been less rapid, or carried along with the stream to the sea. The last, however, is a rare occurrence, unless in situations where the land declines very rapidly towards the shore. In that county, however, it is evident that the whole of the land upon the coast has arisen from the washing and washing away of different points of land, while that in the interior has been produced by the washing of the rivers. It is remarked by a writer mentioned above, that in cases where the proportions of clayey, loamy, or other earthy substances with which they are mixed, approach nearly to that of the sand, the heavier sorts of sandy soils are formed; but that where these enter only in very small quantities, the light sandy soils are formed; and where they are hardly met with at all, the soil is a loose blowing sand, most commonly of a white or brownish appearance. And it is added, that the portions of vegetable matters, that are intermixed with different soils of the sandy kind, are not less various than those of the clayey and loamy, from which considerable differences of quality are produced. These differences in their textures and compositions also introduce others, which respect their powers of admitting and retaining heat and moisture. The openness and want of adherence in such soils, while they allow of the admission of heat and water more readily, permit them to be carried off with greater ease and expedition: they are, therefore, less permanently benefited by their influence than many of the clover and more adhesive soils.

But as these sorts of soils are chiefly deficient in the calcareous, clayey, loamy, and vegetable materials, the aim of the farmer must be the augmentation of their cohesive property, and the supplying the calcareous and decayed animal and vegetable materials. They cannot, of course, be cultivated with advantage, without the aid of other fossile manures to counteract their poverty, and prevent the continual evaporation of moisture. For this purpose, clay and loam may be beneficially spread on sandy soils, which may likewise be improved by the use of composts of animal and vegetable manure: though, where these cannot be obtained, good mould or earth may be employed with advantage, as also may peaty earth, either alone, or in combination with other matters. It has been observed by Dr. Fordyce, that a less quantity of clay is required in the improvement of light sandy soils, than of sand in the clayey ones; but whether this be a practical rule or not, the thinner and poorer sorts of sandy soils mostly stand in need of a large quantity of clayey matter. And when the calcareous property prevails, clayey marles and clayey loams are most proper; but in cases of its being deficient, calcareous marle and loams may be used with more advantage. This has been sufficiently proved by their application in different districts. A degree of tenacity or firmness may also be imparted to sandy soils, by the treading of sheep, folded upon

them; while they receive much benefit from the dung and urine deposited by those animals.

And it may be noticed, that these different materials are proper for being laid on either alone, or in the state of composts; but marles and clayey substances are mostly applied in the states in which they are found in nature; but the farm-yard dung, and peaty substances, in mixture with other matters.

Further, it has also been stated by the author of "Practical Agriculture," that the light, open, and porous texture of sandy soils renders them much more easily cultivated, and kept in order, than those of the strong and close kinds; and, consequently, the farms where they prevail are generally large: but that, when properly prepared, they are better adapted for the growth of many sorts of crops, such as those of the bulbous and tap-rooted sorts. And they have also another advantage, which is that of pushing forward the crops with more expedition. Whatever inconveniences attend them are mostly such as proceed from the want of a sufficient degree of cohesion among their constituent particles, and solidity of texture. On these accounts, they often counteract the best and most judicious management. The roots of the crops are liable to become naked and exposed, from storms and various other causes; and if grain, to fall down and be lodged so early in the season as to render them of little value.

It has likewise been remarked by the writer of the East Lothian Agricultural Report, that there, within these few years, considerable tracts of this kind of soil, formerly of little value, have been brought under the plough, and made to produce excellent crops of turnips, clover, barley, rye, &c. as may be seen in different parts of the Survey; but the most valuable improvement upon this description of soil has been made by laying it into grass, and treating it with top-dressings of different kinds of soils, which, when liberally applied, have, in not a few instances, changed the appearance, and so much altered its nature, as to render it capable of bearing a succession of valuable crops of grain.

Some think lime the best of all dressings for sandy lands. This is the case, in particular instances, in the county of Oxford. On the fine red sandy soils there, some lay from ten to twenty quarters on the acre; the former quantity very common in mixture with earth and some dung. The benefit thus produced is generally great, lasting many years.

Besides these, vast improvements have been made in a variety of other cases on these soils, by the use of the above methods. Their textures, compositions, and properties, have been so amended and improved, as to make them capable of producing crops of most sorts with advantage.

6. *Peaty or Mossy Soils.*—These kinds of soils are more common in the northern districts and in Ireland, than in the southern parts of the kingdom, though in these latter they occur in a small extent. And they, like other sorts of soils, vary from the nature and proportions of the ingredients of which they are composed. It has been observed, that where the vegetable or peaty material predominates but little over the other substances with which it is mixed and incorporated, the lighter sorts of peaty or mossy soils are formed; but where the other matters bear only a slight proportion to it, the deep and heavy peaty or mossy soils present themselves. In different districts the peaty matter is found of different depths, and of various degrees of density or closeness of texture, probably proceeding from some original differences in the vegetable substances from which it was formed, or the greater advances which it has made to the state of perfect decomposition. The sub-soil
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in most of the deep mossy districts is of the clayey kind, more or less stiff and heavy, over which the peaty or mossy material is deposited generally in a sort of stratified order; the first layer of which, being commonly not more than ten or twelve inches in thickness, exhibits the appearance of a richish brown earth, arising, in all probability, from the incorporation of the loamy or clayey matters with the peat or vegetable earth lying immediately upon them, and constituting originally, perhaps, the surface of the ground. The layer that succeeds to this is mostly of a dark colour, and of considerable thickness, apparently formed of a great variety of vegetable and other materials in the more perfect stages of resolution or decay, united together by time and other circumstances, with more or less degrees of compactness and solidity. The uppermost stratum, or that which is placed upon this dense peaty matter, is, in general, of a very pale colour, and very light spongy texture, arising possibly from the grasses, leaves, and other vegetable substances of which it is formed, not having attained that state of decay which constitutes the darker sorts of peaty earth. However, in the more superficial peaty soils, little or nothing of this stratified appearance is met with. A coat of peaty earth, differing greatly in thickness, according to the peculiarity of the situations, and other circumstances, is formed by a great length of time from the destruction and decay of successive crops of grasses, leaves, and other substances of different kinds, and deposited upon, and intermixed with, the various harder materials of the soils which happened to be underneath them. It is observed, that by these means much variety is produced in the soils. Where the under strata of earthy matter are tolerably good, and the crops of vegetables large and luxuriant, the better sorts of light peaty soils seem to be predominant; but where the quality of the under strata is indifferent, and the vegetable products scanty, as well as feeble in their growth, the poorer sorts of these soils are formed. And in many districts, this, as well as the sandy soil, being deposited or superinduced, the bottom being uniformly the same as that of the adjoining grounds, in the low flat parts, owes its origin evidently to the stagnation of water; in these places the moss consists of the roots and decayed leaves of aquatic plants, which are found in distinct strata, and of different kinds, according to their depth. But in situations more elevated, and upon the tops of the highest hills, the moss has been formed in some cases merely by the decay of the plants, which, falling down yearly without being entirely rotted, have, in process of time, accumulated and formed the moss there met with; but in the hollows, its formation is owing to the same deposition, with the addition of a great proportion of earth, washed from the sides of the hills during the floods. In some parts of the county of East Lothian, this soil has made considerable progress towards decay, and nearly resembles black rich loam; but in by far the greatest part, the roots and leaves of the different plants concerned in its formation are in a tolerably perfect state, and when freed from moisture, present little else than a collection of these.

Mr. Somerville concludes, from his experiments made upon moss in all the different stages of decay, that the predominant principle in the whole is an acid; and, according as the moss is more or less decayed, the prevalence of this principle is more or less observable. In the experiments upon moss not much decayed, the quantity of acid was greater, and that of the oil and the alkali less, than in any of the other trials; on the contrary, where it was most decayed, it was found to contain the least acid and the greatest proportion of oil and alkaline salts. A knowledge of these circumstances is of considerable importance in agriculture,

for, by observing the progress that moss has made towards decay, a tolerable idea can be formed of the trouble and expence that will be necessary either to bring it into cultivation, or render it useful as a manure.

And it is suggested, that from the same experiments it would appear, that the constituent parts of moss are, 1, an acid; 2, an alkali; 3, oil; 4, vegetable earth; 5, iron. The iron was met with in one instance only, and in that the quantity of acid was greater than in any of the other trials; the nature of the acid was also different, being evidently vitriolic, a thing seldom met with, unless in cases where the moss contains iron, which is certainly the worst of all its principles, and the most difficult to correct. And it is added, that upon comparing the constituent parts of moss with those of the best soils, they are found nearly the same, with the exception of the acid, but in some different proportions. The alkaline principle in some kinds of moss is scarcely equal to what is met with in good loam or clay, while the oil and vegetable earth are much greater; a great proportion of other soils consists of sand, gravel, earth, &c.; but the earthy part of moss consists entirely of a mould formed by the earthy part of decayed vegetables, together with the sediment of water.

From their composition, these soils must of course be extremely retentive of moisture. It has, indeed, been remarked by the earl of Dundonald, that from the rays of the sun and drying winds being exerted during the summer season in carrying off, by means of evaporation, the superabundant moisture in such cases; and heat being known to be abstracted from bodies, and cold generated thereby, effects must be produced highly injurious not only to climate but to vegetation in general, and more particularly to such plants as stand in need of a higher degree of heat, and more nourishment than such soils are capable of supplying. And further, that there can be very little doubt but that these prejudicial effects on the growth of vegetables extend themselves to the more dry lands adjoining such fens or deep mosses. It has also been found, that the surface-stratum of peaty soils, from its being more exposed to the influence and action of the pure air of the atmosphere, is much less soluble than the under strata, consequently in its simple or unmixed state less proper for the purposes of agriculture. From the same cause, too, it becomes less capable of supporting flame, and is therefore improper for the purposes of fuel, in the way of turf or peat.

The different manners in which mossy or peaty soils are formed, have been seen and explained, in some measure, above, and in speaking of the nature and means of cultivating mossy lands. See *Mossy Land*.

Very extensive improvements, in soils of this kind, have lately been made in Lancashire and different counties in the northern parts of the kingdom, as well as in several districts in Ireland. See *TURFY Land*.

It may be remarked, that these sorts of soils stand in need of different methods of management in bringing them to the condition of producing crops. In those of the deeper kinds, the first thing to be done is to draw off, as much as possible, the superabundant moisture, by the cutting of proper drains, and such other means as the nature of the situation, and other circumstances, will admit of. It has been noticed, that in places where water in sufficient quantity can be conveniently made to pass through such mosses, and where the soil underneath is good, much may be effected by floating away the principal part of the mossy substance; but where the mosses are not deep, or the soils under them of a good quality, after the making of proper drains, the best way is, probably, to ridge them in such directions and

modes as are the most effectual in promoting the exit or passage of the stagnant water which they contain. Different materials may then be applied with the intention of improving their textures, and promoting the dissolution of the undecayed parts of the vegetable matters that are contained in them. The first may be accomplished by the application of various gravelly substances, sand and coarse earth; and the latter, especially where there is a large growth of coarse plants, by the use of lime in its caustic state; but where such plants do not so much abound, alkaline substances, chalk, calcareous marl, the shelly kinds of sea-sand, and the carbonate of lime, may be more advantageously made use of. And as shell-marle, chalky substances, rich clays, and limestone gravels, are frequently met with under deep peat mosses, they should be tried for by boring in various parts. Paring and burning is also useful where the quantity of vegetable matters on the surface is considerable, and of the coarse kind; but the method of applying good earthy matter is to be preferred where it can be procured in an easy and cheap manner. And advantages may be gained in promoting the fertility of these soils by cropping with particular sorts of vegetables, as such as have large branching stems, and cover the surface of the ground very much, so as to exclude the action of the air in a great measure upon it.

It is probable, too, that the hot limes, as they are called by farmers, may be laid upon these soils in full proportions with very great advantage in some cases; and that where lands of any kind have been hurt by the too great use and abundance of them, peat will prove a good means of restoring them.

In these different ways very great improvements have been made in peaty and mossy soils, especially where the drains have been formed sufficiently near to each other, and to proper depths for taking away the water in an effectual manner. Great advantage has also been derived by laying the surfaces of such lands over with any sort of heavy earthy matters to the thickness of three or four inches, such, for instance, as the heavy sorts of marle, the scrapings of roads, the heavy mud of rivers and ponds, &c. By these means, where they are intended for grass, a finer kind of herbage is brought up, and where for the purposes of tillage, the surface is well consolidated, and rendered more suitable to the growth of crops of that sort.

7. *Boggy Soils*.—These are also soils that have much of the nature of the preceding, but which differ in some respects from them, being chiefly in low confined situations, and of less depth than the heavier mossy soils, and of more than those of the lighter description of that sort of soil. There are soils of this description frequently met with in Ireland, and occasionally in low meadows and near large ponds or lakes in this country. These soils are gradually formed by the deposition and decay of the different vegetables that grow in such situations as those of the luxuriant aquatic kinds; and the stagnation of much moisture upon them, by which the roots also become destroyed and reduced to the state of earth. They have of course different appearances or colours, according to the state of putrefaction and decay to which the different parts have advanced, and the nature of the other earthy materials with which they are blended; in some cases being of a lightish brown aspect, as where the fibrous and ligneous matters have only undergone a slight change; but where this has been carried to a considerable extent, they are of a dark colour, approaching to black, or of a deep dusky hue. See PEATY and MOSSY Land.

As the great defects in soils of this nature are chiefly those of their being too much charged with moisture, and of too open and porous a texture, the means of bringing them

into a proper condition are obvious. In deep boggy soils, the business of draining should first, when practicable, be resorted to, in order to draw off the excessive moisture. After which, various hard dry earths will be found of great use in improving bogs, such as gravel, chalk, stony matters, sand, shell-marle, &c. as these substances contribute to bind, ameliorate, and warm the soil, while they prevent springs from oozing out and overflowing the surface. Where they are over-run with rushes and similar coarse vegetables, quicklime may be beneficially applied, and paring and burning may be employed, sometimes with advantage. And another useful mode of reclaiming such soils is, by planting on them those vegetables whose spreading roots serve to bind the earth together, and at the same time, in a great measure, exclude the action of the atmosphere upon it. The practice of flooding, also, where a command of water can be obtained, has proved a cheap and efficacious mode of reclaiming them in some instances. Some cases, at least, have occurred where such soils have been brought into a state of cultivation for meadows, with the happiest success, by it, which had failed under contrary methods of management.

In most of these cases, the first means which are necessary, after well ditching and draining the soils or lands, and levelling the imperfections and inequalities on their surfaces, is to apply earthy matters over them. For this purpose, the lumpy earthy parts, or elevations on them, are to be pared off and intimately blended up with lime into composts, which, with other heavy materials of proper earthy kinds, are to be placed and spread out on the lands or soils in an even manner. And afterwards, when the ground or soil becomes firm and solid, with much coarse plants and herbage rising upon it, eating it constantly close down with light neat cattle and sheep, will be very beneficial, especially where such soils or grounds are designed for pastures. When for tillage, there are various other means which may be had recourse to in different circumstances, for rendering them more firm and dry, with great success. See SWAMPY Land.

The management of such soils, in all these different methods, has been productive of great benefit in different instances, and the land, when improved, is commonly of the most valuable kind. See BOG, and SPRING-Draining.

8. *Heathy or Moory Soils*.—These form a class of soils that occupy very extensive tracts in different districts of the kingdom, and which have considerable relation to those of the peaty sort, though they differ in many particulars. In the southern part of the country they are mostly known under the titles of *heathy* or *moory* soils, but in Scotland they have the name of *muir* soils.

It is remarked by Mr. Somerville, in the agricultural Survey just noticed, that these soils, like those of the mossy kinds, owe their origin evidently to the same cause, namely, the decay of the plants that formerly occupied the surface. This muir soil is of two kinds, one of which is black, soft, and porous, and admits moisture in a greater degree than any other soil; it is at the same time covered with stones of a white colour; evidently whinstone bleached with an acid: the parts, when examined, exhibit the appearance commonly met in turning over the ashes formed by the burning of vegetables, where the skeletons of the plants and roots are seen naked, sapless, and destitute of any of the useful properties they once contained. It is difficult to form an opinion of the cause of these appearances, or to conceive how lands that had once been covered with plants so strong and numerous as to form a thick sod, should become so barren as to be totally unfit for vegetation, as the greatest parts of these muirs are. Were a judgment to be formed from appearances,

fire might be supposed to have been the cause; but as the consumption of vegetables by that element, however great the waste may be of a part of their useful principles, is always productive of more or less fertility, the appearances above-mentioned must be owing to causes of which no correct opinion seems to be at present entertained. This description of muir is the most barren, and its improvement the most hopeless, of any soil known there, and no attempts hitherto made have either rewarded the enterprise of the undertakers, or held out inducements to others to follow their example. But there is another species of muir soil, which consists, like that already described, of a stratum of vegetable substances upon the top, not of a black or burnt appearance, but resembling the plants in a dry state intermixed with earth, without having been acted upon by any thing but the weather. These, when examined, are found to contain a considerable proportion of the properties common to all vegetables, and when properly treated, are capable of being converted into a soil friendly to vegetation. The stones upon this kind of muir are of the same colour with those met with upon the best soils. There are considerable tracts of this soil, which, by good management, might be considerably improved: indeed a great part has been much ameliorated of late years, in many districts, and is in a progressive state of improvement.

And in the analysis of the same writer of the turf of these soils in the district noticed above, he discovered nearly the same principles as are found in those of the mossy kind.

No gypsum was obtained from this turf, nor did the trial by the magnet discover any iron. Many other trials were made with different kinds of turf, taken principally from muirish soils, the result of which seems to establish the constituent parts of the turf to be, 1, an acid; 2, an alkali; 3, oil; and 4, vegetable earth, in a considerable quantity. In cases where the turf is pared very thin, it is found to contain less acid and more alkaline salts and vegetable earth than where it is deep cut, and much of the soil taken along with it.

In the improvement of these kinds of soils different methods must be pursued, according as they possess more or less of the vegetable principle, and as they are of the deeper or thinner kinds. Where there is much heath, the great object will however be that of destroying it as quickly as possible, in which view paring and burning may be had recourse to with vast advantage and success. The application of caustic lime has likewise been found highly beneficial in the same intention.

The use of different substances of the animal and vegetable kinds, as dung and the mud of ponds, in the form of earthy compoils, may likewise be found advantageous on soils of this nature, with judicious modes of cropping with plants of the grain and green kind; the latter being fed off as much as possible upon the land by sheep.

Some think the best means of improving all sorts of soil of this nature, is, after the heath has been, in some measure, removed, where it is long, by the application of lime or marl over the surface, allowing it to continue in that state for the space of two or three years, when these soils are to be broken up and sown with proper sorts of crops in alternation with turnips and potatoes, the ground being laid down again to grass when it has been brought into proper condition for it. The turnips, where it is practicable, should always be eaten off upon the ground. Where the heath is of the long strong kind, it may be destroyed either by burning, pulling it up by the roots, or by suffering the grass to rise and choke it up. See *WASTE-LAND*.

All these and some other modes may be practised in

improving heathy soils with much success in different cases.

It therefore appears, from the whole of what has been said upon soils, that great care and attention are always requisite in improving the nature and qualities of them, and that the farmer should constantly be properly on his guard in undertaking such sorts of work.

SOIL, in *Gardening*, the fine surface-mould or earthy materials, in which plants and trees grow and afford their produce. Different sorts or qualities of soils are necessary, in this point of view, for different uses and applications; but for the more general purposes of culinary gardening, those of the more light and dry loamy kinds, which are readily broken down and reduced in their particles, are probably the most extensively useful and beneficial, particularly when they have been well impregnated and enriched with proper sorts of manure, or other similar matters. See *COMPOST* and *MANURE*.

Some, however, think that the best general soil in this intention, is that middling kind of loam, which, in some parts, is capable of being made of very different degrees of lightness and friability, so as to suit and be proper for different sorts of vegetable crops, by the simple addition of sand or sandy matters, in due proportions; and in other parts, of different degrees of stiffness, tenacity, and cohesion, by the suitable addition of clays or clayey materials, in the necessary quantities. There are others who prefer soils of very different natures and qualities, or which are very differently constituted, for the use of raising the many different sorts of garden vegetables, and think it incapable of being accomplished in the best and most perfect manner, where this is not the case. It is therefore probable, that considerably more latitude in respect to the nature of soils is necessary in the garden cultivation of plants, than in that of the field.

In general, the depth of a garden-soil, where the bottom or sub-soil is perfectly open and dry, should be considerable, as not less than three feet, or more, in any case where such a depth is to be procured; but where there is a bottom or sub-soil of rather moist clay, or any other impervious material of that nature, a less depth may sometimes be more suitable and proper, and particularly where such bottom or sub-soil has been well drained and freed from too much wetness: however, in all or most instances where this is incapable of being properly effected, or the trouble and expence of getting and providing a stratum or layer of gravel, or other similar substance, to be placed over it, are too great to be incurred, the depth of the soil should not by any means be less than four feet, as when it is of less thickness, there may be danger of the roots of herbaceous vegetables, and of fruit and other trees, reaching and striking into it, and being thereby greatly injured or destroyed. And for some purposes, as those of growing particular kinds of fruit-trees, such a soil would be quite ruinous and wholly improper, unless some sort of impediment was given to the roots striking downwards, by forming a kind of pavement with stones, bricks, or tiles, about two and a half or three feet under the surface of the ground, just above the clayey bed. The depth of good garden soils should, of course, in common, be from two to three feet, and in particular cases four feet or more. The nature of the particular soils, and the sub-soils or bottoms on which they rest, must, however, in a great measure, regulate their depths.

In cases where the natural soils of gardens are to be removed, and those of new and better kinds formed and provided, much regard is necessary to be had, in the introduction of the different kinds of earthy materials of which they are to be composed. The soils of all the different parts are

modes as are the most effectual in promoting the exit or passage of the stagnant water which they contain. Different materials may then be applied with the intention of improving their textures, and promoting the dissolution of the undecayed parts of the vegetable matters that are contained in them. The first may be accomplished by the application of various gravelly substances, sand and coarse earth; and the latter, especially where there is a large growth of coarse plants, by the use of lime in its caustic state; but where such plants do not so much abound, alkaline substances, chalk, calcareous marle, the shelly kinds of sea-sand, and the carbonate of lime, may be more advantageously made use of. And as shell-marle, chalky substances, rich clays, and limestone gravels, are frequently met with under deep peat mosses, they should be tried for by boring in various parts. Paring and burning is also useful where the quantity of vegetable matters on the surface is considerable, and of the coarse kind; but the method of applying good earthy matter is to be preferred where it can be procured in an easy and cheap manner. And advantages may be gained in promoting the fertility of these soils by cropping with particular sorts of vegetables, as such as have large branching stems, and cover the surface of the ground very much, so as to exclude the action of the air in a great measure upon it.

It is probable, too, that the hot limes, as they are called by farmers, may be laid upon these soils in full proportions with very great advantage in some cases; and that where lands of any kind have been hurt by the too great use and abundance of them, peat will prove a good means of restoring them.

In these different ways very great improvements have been made in peaty and mossy soils, especially where the drains have been formed sufficiently near to each other, and to proper depths for taking away the water in an effectual manner. Great advantage has also been derived by laying the surfaces of such lands over with any sort of heavy earthy matters to the thickness of three or four inches, such, for instance, as the heavy sorts of marle, the scrapings of roads, the heavy mud of rivers and ponds, &c. By these means, where they are intended for grass, a finer kind of herbage is brought up, and where for the purposes of tillage, the surface is well consolidated, and rendered more suitable to the growth of crops of that sort.

7. *Boggy Soils*.—These are also soils that have much of the nature of the preceding, but which differ in some respects from them, being chiefly in low confined situations, and of less depth than the heavier mossy soils, and of more than those of the lighter description of that sort of soil. There are soils of this description frequently met with in Ireland, and occasionally in low meadows and near large ponds or lakes in this country. These soils are gradually formed by the deposition and decay of the different vegetables that grow in such situations as those of the luxuriant aquatic kinds; and the stagnation of much moisture upon them, by which the roots also become destroyed and reduced to the state of earth. They have of course different appearances or colours, according to the state of putrefaction and decay to which the different parts have advanced, and the nature of the other earthy materials with which they are blended; in some cases being of a lightish brown aspect, as where the fibrous and ligneous matters have only undergone a slight change; but where this has been carried to a considerable extent, they are of a dark colour, approaching to black, or of a deep dusky hue. See PEATY and MOSSY Land.

As the great defects in soils of this nature are chiefly those of their being too much charged with moisture, and of too open and porous a texture, the means of bringing them

into a proper condition are obvious. In deep boggy soils, the business of draining should first, when practicable, be resorted to, in order to draw off the excessive moisture. After which, various hard dry earths will be found of great use in improving bogs, such as gravel, chalk, stony matters, sand, shell-marle, &c. as these substances contribute to bind, ameliorate, and warm the soil, while they prevent springs from oozing out and overflowing the surface. Where they are over-run with rushes and similar coarse vegetables, quicklime may be beneficially applied, and paring and burning may be employed, sometimes with advantage. And another useful mode of reclaiming such soils is, by planting on them those vegetables whose spreading roots serve to bind the earth together, and at the same time, in a great measure, exclude the action of the atmosphere upon it. The practice of flooding, also, where a command of water can be obtained, has proved a cheap and efficacious mode of reclaiming them in some instances. Some cases, at least, have occurred where such soils have been brought into a state of cultivation for meadows, with the happiest success, by it, which had failed under contrary methods of management.

In most of these cases, the first means which are necessary, after well ditching and draining the soils or lands, and levelling the imperfections and inequalities on their surfaces, is to apply earthy matters over them. For this purpose, the lumpy earthy parts, or elevations on them, are to be pared off and intimately blended up with lime into composts, which, with other heavy materials of proper earthy kinds, are to be placed and spread out on the lands or soils in an even manner. And afterwards, when the ground or soil becomes firm and solid, with much coarse plants and herbage rising upon it, eating it constantly close down with light neat cattle and sheep, will be very beneficial, especially where such soils or grounds are designed for pastures. When for tillage, there are various other means which may be had recourse to in different circumstances, for rendering them more firm and dry, with great success. See SWAMPY Land.

The management of such soils, in all these different methods, has been productive of great benefit in different instances, and the land, when improved, is commonly of the most valuable kind. See BOG, and SPRING-Draining.

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In general, the depth of a garden-soil, where the bottom or sub-soil is perfectly open and dry, should be considerable, as not less than three feet, or more, in any case where such a depth is to be procured; but where there is a bottom or sub-soil of rather moist clay, or any other impervious material of that nature, a less depth may sometimes be more suitable and proper, and particularly where such bottom or sub-soil has been well drained and freed from too much wetness: however, in all or most instances where this is incapable of being properly effected, or the trouble and expence of getting and providing a stratum or layer of gravel, or other similar substance, to be placed over it, are too great to be incurred, the depth of the soil should not by any means be less than four feet, as when it is of less thickness, there may be danger of the roots of herbaceous vegetables, and of fruit and other trees, reaching and striking into it, and being thereby greatly injured or destroyed. And for some purposes, as those of growing particular kinds of fruit-trees, such a soil would be quite ruinous and wholly improper, unless some sort of impediment was given to the roots striking downwards, by forming a kind of pavement with stones, bricks, or tiles, about two and a half or three feet under the surface of the ground, just above the clayey bed. The depth of good garden soils should, of course, in common, be from two to three feet, and in particular cases four feet or more. The nature of the particular soils, and the sub-soils or bottoms on which they rest, must, however, in a great measure, regulate their depths.

In cases where the natural soils of gardens are to be removed, and those of new and better kinds formed and provided, much regard is necessary to be had, in the introduction of the different kinds of earthy materials of which they are to be composed. The soils of all the different parts are

to be formed and prepared with great attention to their several uses and intentions; and where fruit-trees are to be grown, particular care should be taken, that the borders for such purposes be formed and made up to proper depths, with suitable materials, and upon proper kinds of sub-strata. By sufficiently regarding these points, garden soils of proper qualities, and fit for every purpose, may mostly be provided without much difficulty.

The work of forming and composing garden soils is by far the most cheaply, properly, and easily performed at first when the garden is laid out; as, when done at an after period, great injury and destruction are caused in different finished parts, and in various other places, by defacing and cutting them up in the labour, and rendering their appearance disgusting to the eye, though the business is still capable of being accomplished without any very great difficulty or expence. In all cases of this sort, whatever depth of natural soil may be wanting to form the soils to the proper depths or thicknesses, as suggested above, must be supplied, by conveying it into the garden from the neighbouring lands or other situations, where the proper kind is to be met with in sufficient quantity; as it is rarely, or never advisable to raise and mix up any great quantity of the sub-soil, or bottom part, whatever its nature, texture, or properties may be, with it. For, in many cases, the soils of gardens are greatly injured, or nearly ruined, by the improper mixing of the sub-soil with the surface-mould. Level spots are seldom so proper for gardens as others, as the soils of them have rarely a dry bottom, and the draining of them, when necessary, is a great deal more difficult, than where there is some degree of declivity. Where there is from a foot in twelve, to that of a foot in thirty or forty feet, it will commonly succeed pretty well; but when about one foot in twenty-five, it has the most happy effect in freeing the soil and sub-soil from too much wetness.

It is remarked by the "Scotch Forcing and Kitchen Gardener," as a fortunate and desirable circumstance, that in many instances the different sorts of soil are met with in the same acre or portion of ground, and that they should never be wanting in the same garden, but that where they are naturally deficient, in this respect, in such situations, recourse must be had to artificial means, in the manner that has been already suggested, for providing and producing them; for the variety of vegetables which are to be cultivated in gardens require a variety of soils in them for their production. It would, however, be perfectly absurd, if it is supposed, to conceive, that for every particular sort of vegetable there should be a particular kind of soil formed and prepared. The varieties of soil which are absolutely necessary in almost any garden, may, it is thought, be confined with propriety to the following,—strong clayey loam, —light sandy loam, a composition of one-fourth strong, with three-fourths light loam, half strong and half light, and one-fourth light and three-fourths strong; the two first being obviously the grand or principal sorts, and made to form and compose the whole of the others. These, with the proper and suitable applications of manures to them, may, it is believed, be rendered capable of producing any of the known and commonly cultivated garden vegetables, in the highest state of perfection.

This is probably, however, limiting them too much or too narrowly, as though the principal sorts of culinary vegetables may be raised upon them in an easy and perfect manner, there are several kinds of plants grown in such situations that require soils of other qualities to produce them in perfection, and some that cannot be grown at all without those of quite a different nature.

Garden soils, in many cases, may be greatly and cheaply improved by very simple means, as by the properly drawing away and discharging any over-degree of moisture, where the bottom is wet, and the sub-soil of a cankering ochrey quality; and by supplying and intimately incorporating with the soil, where it is of a very stiff obstinate nature, substances of the small gravel, pebbly, and shelly sea-sand, coal-ash, lime-gravel, reduced brick-bat, brick-kiln ash, mouldering-chalk, and different other similar kinds. In cases where the soil is of a poor sandy, gravelly, or other quality of somewhat the same description, the improvement is to be effected by supplying and intermixing clay, strong clayey loam, scourings of ditches found on clayey sub-soils, muddy depositions of similar situations, scrapings of muddy roads, and other matters of the same kind with them, in suitable proportions and an even manner.

Where soils of the pure sandy, sea-sandy, or peat-earthly kinds, are wanted, they are to be formed by the supply of these different sorts of materials in the proper and necessary proportions to some part of the common soil of the garden, as the case may be, without their being blended or united with it. In all other cases the business is to be accomplished in somewhat similar ways.

It is a very common opinion among gardeners, that culinary vegetables may be raised and grown to the best advantage, and in the fullest perfection, on what is denominated *new*, or rather fresh lands or soil, and this is evidently proved to be the case in a great number of instances. The soil or ground, in consequence of its being exhausted, or *worn out*, as it is termed, is found incapable of producing certain kinds of vegetables of the above nature; not because it is of a poor or hungry nature or quality, or that it is wholly unsuitable for the production of them, having probably, at a former period, produced them in an abundant manner, but on account of, or from the surface soil having been so long under such crops without any sufficient or suitable change. This is, however, much less the case, in open field garden grounds, than such as are inclosed for the purpose of producing the finer sorts of fruit and vegetables.

The inconvenience in these cases is supposed to be capable of being wholly removed, or greatly relieved, by trenching the soil in a peculiar manner at proper periods, so as to have constantly a new or fresh soil for the growth of such vegetables and fruits. See *Rotation of CROPS*, and *TRENCHING*.

The soils of gardens in all cases, except where they are too light and friable, are capable of receiving much improvement, by being fully laid up in such a manner as to expose the largest possible surface to the operation of the weather, whenever they are unoccupied by crops, and especially during the frosty periods of winter. On all stiff, heavy, clayey, loamy, and cankering gravelly soils, the improvement by this means is very great, and ought never to be neglected. On very light soils of the sandy sort, it should, however, be very cautiously employed. See *RIDGING up*.

The most suitable kinds of soil for the growth of different sorts of fruit-trees in gardens, are very various according to their nature and habits, but they all require that they should be of a somewhat dry quality, as will be seen under their different proper heads. Where fruit-trees of the apple kind are grown in such situations, which should as rarely as possible be the case, they succeed in the best manner, are the most healthy, and of the greatest durability in soils of the brown loamy kind, which have a middling degree of consistence, and a depth of a foot and a half or more, resting on a dry, sandy, or soft clayey bottom: they will, however, answer tolerably on any of the loamy sorts of soil
which

which lie upon dry substrata. In all soils which have wet retentive bottoms, they are soon destroyed. The pear stands in need of a stronger and more clayey soil than the above, which has much greater depth, but which rests on the same sort of substrata. Similar sorts of soil are also the most adapted to the growth of the cherry and the plum. And the small fruit-trees, in such cases, may be well grown in any soil which is not of the ochrey or wet stiff clayey kind. See *SMALL Fruits*, and *STANDARD Fruit-trees*.

Soils for the purpose of ornamental gardening are not only of great utility in growing and rearing the different plants and trees which are necessary for it, but have been employed in the way of contrast, and for relieving them. Formerly, much advantage was taken in this manner, by the introduction of different coloured earths or soils, but they have since, probably with justice, been reprobated as too trifling and insignificant by lord Bacon: the natural soil throughout is always, Mr. Loudon thinks, preferable; and when tastefully varied by the green of vegetation, will have a very harmonious effect in such cases.

The quality of the soil for the growth of most sorts of ornamental plants and shrubs, should, it is said, be rather poor; for most of those of the wild or botanical kind, various, though principally dry pasture loam of a virgin nature; but for the ericas or heath sorts, and most of the American and Cape plants, as well as some others, mostly or peaty, and rather moist.

The soil, in its different kinds, has much effect in improving, or *breaking*, as it is termed by the florists, some sorts of fine flowering plants, as several of the bulbous-rooted and more tender herbaceous kinds, such as tulips, pinks, carnations, and many others. The common plants of the latter description will, it is believed, grow in almost any sort of soil.

The particular sort of soil in which most of the moss-plants and shrubs commonly grow to the best advantage, is, it is supposed, that of a sandy moss or peat of a moderate degree of moisture. The soils for wild plants are almost, it is remarked, as various as their names, but, in common, such as are mentioned below, will grow most of them when cultivated in a garden:—dry virgin mountain earth or soil; mossy earth or soil in a damp situation; half of each of the above in a moist situation; half of each in a dry position; moist clay and moss or peat well blended; dry gravel and sand incorporated well together; a clear sandy or gravelly bottom soil, where there is a slight trickling of water; a muddy bottom soil, in a low stagnant pond or other water; rock-work, differently constructed, forms a soil for certain plants, as some mosses, ferns, and others of the same sort; living full-grown trees, as well as such as are decayed, provide a soil for the growth of particular mosses and funguses; the soil of the sea-shore is proper for the growth of sea-plants; and the differently formed soils in heated houses and other places, are suited to the growth of most sorts of exotic plants. The two first sorts, with those of the trickling and sea-shore kinds, will, however, it is supposed, nearly serve the purposes of all the others, when properly managed.

For the purpose of raising different sorts of forest-trees, and forming ornamental plantations, great variety of soils is necessary; such as those of the more light sandy and gravelly kinds, which rest upon free, open, porous under soils or bottoms; sandy and gravelly loams on the same sorts of bottoms; the same and perfectly loamy soils, on bottoms which are of a more retentive or wet nature; chalky or calcareous loams, and gravelly mouldering chalks on open bottoms; loamy clays and clayey loams, on similar bottoms; strong soils of both these

sorts on more retentive and moist under soils; thin, peaty, heathy, and moory soils, which lie on gravelly and other sorts of open dry bottoms; and similar soils, resting on more stiff and retentive substrata, or such as are of a moister quality.

Other variations in the nature of garden-soils may likewise be occasionally necessary for particular purposes, as well as in those of grounds which are intended to be laid out and ornamented.

SOIL, Night, in *Agriculture*, the excrementitious matter which is taken from privies or other places in which it is deposited. Sir Humphrey Davy has remarked, that it is a well-known very powerful manure, which is extremely liable to decompose. That it differs in composition, but constantly abounds in substances constituted of carbon, hydrogen, azote, and oxygen. And that from the analysis of Berzelius, it appears that a portion of it is always soluble in water; and in whatever state it is employed, whether recent or fermented, it supplies abundance of food to plants, either as crops, or in other ways.

It is suggested, that its disagreeable smell may be corrected and destroyed by mixing quicklime with it; and that, if exposed to the atmosphere in thin layers, strewed over with quicklime in fine weather, it speedily becomes dry, is easily reduced into powder, and in this state may be made use of in the same way as rape-cake and other similar manures, being delivered into the drill-furrows at the same time with the feed.

The refuse of charcoal warehouses, and the powdery matter of that substance, might also probably be intermixed with the calcareous and excrementitious materials in the above composition with great advantage.

It is stated that the Chinese, who have more practical knowledge of the use and application of manures than any other people existing, mix their soil of this sort with one-third its weight of a fat marle, make it into cakes, and dry it by exposure to the sun. These cakes, as has been said by the French missionaries, have no disagreeable smell, but form a common article of commerce in the empire. It is supposed that the earth, by its absorbent properties, probably prevents, to a certain extent, the action of moisture upon the excrement, and likewise defends it from the effects of the air.

The Japanese, and some other of the eastern nations, are likewise very careful in preparing and preserving this sort of manure; and different methods of collecting, increasing, and securing it in this country have been noticed in speaking of manure. See *MANURE*.

It is supposed by some to have a great superiority over all other sorts of manure, even that of the rotten horse-dung kind, being considered nearly five times as valuable as this last sort. There is consequently believed to be a great saving in the purchase of this manure, by those who have the carting of their dung seven or eight miles, as their teams would bring as much of it in one, as would be equal to what is usually brought of the other by them in five days: that they would have as much as is equivalent in value for one guinea, to what formerly cost them five. And though the price of it may be on the increase, that should not, it is thought, deter them from the purchase of it, as the saving in carriage is, it is said, amply sufficient to repay every advance in the first cost of the material.

Others, however, suppose that this sort of substance in manuring land will not go farther than three times that of common dung, in giving fertility. It is usually sold at 5s. the load. It has lately, in some places, been the practice to mix and work up this sort of soil or excrement with mould or other earthy matters, in a regular manner, to considerable

siderable extent. This is largely done, it is said, in the neighbourhood of the metropolis.

Upon the whole, considering the smallness of the quantity which is necessary, this may be allowed to be the most powerful and effectual manure of any which is now in use for improving land.

In the county of Essex, about Hornchurch, Mr. Newman has found that, for pasture, this sort of manure is, of all others, the most capital; two waggon-loads on the acre, which cost 7*s.* besides carriage, are, it is said, beyond every thing, and secure a carpet of fine herbage. On corn-land, however, it is thought that it forces straw too much. Others have also found this to be the case, but when well mixed with good earthy substances, in sufficiently full proportions, there can be no doubt of its being equally suitable for raising good grain crops.

On account of the increasing scarcity of manure, this sort of material should be every where more attended to and preserved than has hitherto been the case; and it may be largely increased as a manure by the addition of suitable quantities of earthy or other proper matters, according to circumstances, and the purposes for which it is to be employed, as well as be rendered more fit and convenient for carriage and application.

SOIL, Preparation and after-cultivation of, for and in planting, in Agriculture and Gardening, the manner of rendering it suitable and proper for the reception of the trees, and of keeping and preserving it in order afterwards.

The nature, situation, and state of the soil, must unquestionably have much influence in determining and directing the degrees of preparation that may be requisite in the different cases; and though there may be some soils which require very little, this can but seldom be the case, as good soils should never be planted, except for ornamental purposes, and then as little as possible. It consequently appears proper, that some degree of preparation of the soil should constantly take place in almost all cases, however the mistaken notion in regard to the expence attending it may have hitherto prevented the general adoption of the practice.

The expence of the proper preparation of the soil, before the work of planting commences, in many cases, is not by any means great, when properly managed; and in no few instances, may be more than repaid by the kinds of crops that are afterwards grown for two or three years, and sometimes longer: nay, even where such crops cannot be raised and produced, the saving in plants and planting, which would otherwise be required, will often wholly or nearly defray the charges of the preparation. Thus, it is said by Mr. Loudon, that, independently of timber produce, it would seem that the extra charges of preparing the soil may commonly be provided for in the immediately succeeding years to the work's being finished, either positively by the growth of proper crops, or negatively by obviating the incurring of additional expences. And that, when the difference in the returns of timber produce are taken into the account, it may appear astonishing that the cultivators in this way should disregard their own advantage so much as to neglect and omit the proper preparation of the soil. For if it should be supposed that, during the first ten years, trees grow only twice as fast where the soil is properly prepared, as where it is not, then even a plantation worth 100*l.* in fifty years, had the soil been well prepared, would have been worth 200*l.* in the same length of time. But it must be allowed that many kinds of deciduous trees will grow three, four, and even ten times faster in prepared than in unprepared ground, and, of course, the return of profits be in the same proportion.

These statements can surely leave no doubt of the propriety of preparing the soil with a view to these sorts of undertakings.

The preparation of the soil will vary according to its nature, and the circumstances of it; after the stagnant wetness, where present, has been properly removed, and the surface impediments cleared away as much as may be found necessary. In all stiff soils the land must be more wrought and exposed than in the contrary sorts, which often require but little stirring or exposure. In extensive tracts, the ground or soil, when possible, should be prepared by means of the plough, by turning it up and exposing it to the operation of the atmosphere and frosts in the summer, autumnal, and winter months, when of the more rough and obstinate kind, repeating the ploughings, and making harrowings as there may be occasion. In extremely rough moory, and some other coarse sorts of soil, this may be necessary for more than one season. After this, trench-ploughing may be had recourse to wherever it is wanted, and is capable of being practised. By the use of the plough in these ways, the organic matter becomes more decomposed, and the particles of the soil more fully and completely broken down and reduced, than by performing the work with the spade, while the cost is not more than one-third.

In places where the plough cannot be admitted, other methods must be had recourse to, as those of the spade, the broad-mouthed mattock, and the sharp-pointed strong hoe. The spade must be employed in all cases where digging and trenching can be practised, where the plough cannot work, and in forming pits, slits, and other modes of putting in the plants. Where the spade cannot be made to perform the business, the mattock not unfrequently does the work in a ready and effectual manner. And where the mattock cannot be brought into use, the hoe often completes the work without difficulty. The two last methods may be useful in steep banks and spots filled with stones and other obstructions to the spade. The soil in all these cases is to be properly reduced and rendered sufficiently fine for the reception of the tree-plants, by being stirred, incorporated, and mixed together in a suitable manner.

Particular situations may require particular modes of preparing the soil and putting in the plants: thus, where there is danger of loose soil being carried away by winter rains, the land should be prepared in the previous summer season, by making holes or openings, the earth of one of which is thrown into another with the turf or sward-side downwards, which, when opened again for planting, is become rotten, and intermixed with the rest of the soil in putting in the plant. In other situations, where the wind and rain are liable to carry off the soil, the only safe mode of preparing the soil is in pits, holes, and slits, and placing the plants in them. And in still more difficult places, little or no preparation is necessary, only putting in the plants in openings or slits, or sowing the seeds, which will often grow in rocky crevices, where little or no earthy matter is to be seen or met with. The nature of growth in the plants or seeds points out in some cases the modes of preparation of the soil for them; thus, in the very young plants, and in seeds of the oak-kind, where they are only used, the placing them in holes or pits, prepared in a proper manner, is all that is necessary, as they receive the chief of their support from their tap-root, which runs directly downwards.

In regard to the cultivation of the soil, after the work of planting the young trees has been performed, it must obviously be of great use and importance to keep the surface loose, clean, and free from the production of all sorts of improper plants of the weed kind, as the health, growth, and

and success of such tree-plants will very much depend upon it; and, besides, it may be advantageous in other ways. In cases where this is neglected, or improperly managed, there is often much injury sustained by the young tree-plants, as they are not unfrequently liable to be more choked up and inconvenienced in their growth by the rising of coarse grasses and other productions, than if the soil had not been prepared previously to the trees being put into it. The cause of this is thought, by Mr. Loudon, to be extremely plain; as, if the soil, by preparation, be better suited to the growth of trees which are foreign to it, it must be much better adapted to the growth of the plants which it naturally produces in abundance. Consequently, to check and remove these, so that the roots of the young tree-plants may range, and extend themselves in a free manner, so as to require and enjoy the full strength and support of the soil, must be of very material benefit in raising plantations of the tree-kind.

The nature of the cultivation which is to be pursued must be varied so as to suit the particular quality of the soil, the situation, and the kind of plantation for which it is employed; but the great object, in all such cases, should constantly be, to have in view utility, with as much immediate profit as possible, without the risk of injury to the young tree-crops. Consequently, wherever the ground or soil is capable of admitting and producing any sort of proper useful vegetable, and the roots of the trees do not interfere by approaching too nearly to each other from the different rows, some of them should be planted, or the seeds of them sown in a regular manner, all along the centre parts of the intervals between such rows, for some length of time, as a year or two, and more in some instances, after the planting has been performed. The most useful and valuable vegetable crops to be grown in this way, are those of the potatoe, turnip, cabbage, dwarf bean, and some other similar ones of the green kind. The introduction of such crops necessarily supposes that the whole of such planted grounds are to be wrought over, and kept in a clean order by some proper means, during the lengths of time that have been stated; after which they need only be hoed over two or three times in the course of the year, until the surfaces of them be covered and concealed by the trees, which they will mostly be about the fourth or fifth year from the period of planting: All the work of the above kind, where the scale of planting is extensive, may be executed by means of the plough and horse-hoe; except occasionally, perhaps, some little hand-hoeing about the bottom stems of the tree-plants, where there might be danger in letting the other tools work too near them. Where, from different circumstances, it may be impossible to introduce the plough, the spade and hand-hoe must, of course, be had recourse to in working the soil. But wherever the soil is incapable of admitting and producing useful vegetables, or where it may be thought not advisable to grow and cultivate them, the ground or soil may perhaps be the most properly and advantageously preserved in clean order, simply by hoeing over the surface; or sometimes probably by light ploughing or working with the spade, for a year or two at first, and then to depend on hoeing. The chief point in all cases is the promoting the progress of the young trees, and the preventing them from being injured by the stiffness, rawness, and want of cleanness in the soil.

Whenever the surface of the ground or soil is covered by the young trees, there is no longer any necessity for cultivation, it being from that time preserved in a sufficient loose and open state, and the surface properly free from weedy matters, by the closeness and shade of the trees, and the annual falling of the leaves; and particularly where the

planting consists of resinous trees. It is noticed, too, by the above writer, that it is the peculiar property of deciduous plantations, that the surface among them is covered with herbage of the pasture kind, the seeds of which should be sown when the trees are about nine inches or a foot in diameter, they having been well preserved from weeds previously to the period of sowing. See PLANTATION and PLANTING.

It is not improbable, but that when the business of preparing and cultivating the soil for plantations becomes better understood, and its uses and advantages more fully appreciated, more suitable implements, tools, and contrivances may be provided for accomplishing the work in a more easy, ready, cheap, and convenient manner, than has yet been employed.

SOILS, *Cutting Surface of*, the opening and breaking the surfaces of them in different intentions; as for the purpose of rendering them more dry and firm, of producing a more mellow, mouldy, or powdery state in them, and for improving the nature of their swards and grassy herbage in those of the mossy, rough, mowing, and pasture kind. It may likewise be useful to them for some other purposes in husbandry. It is performed in different manners, and by different means, according to the circumstances of the different cases, and the uses which it is designed to serve. See SPIKE Roller, and SWARD Cutter and Dresser.

SOIL, in *Zoology*, is used in some parts of England as the name for the *phoca*, or *sea-calf*.

This creature, in Cornwall, they frequently find sleeping on the shore, and kill him, sometimes by shooting, and sometimes by striking him over the head with long poles. He defends himself, when on shore, by throwing stones backwards with great violence.

SOILING, in *Agriculture*, the practice of supporting animals of different kinds, in the summer season, with green food of various sorts, cut daily, and given to them in racks in the houses, stalls, or yards. A vast number of different plants and grasses may be had recourse to in this intention, as almost all those which have a quick and luxuriant growth; as lucern, tares, clover, saintfoin, chicory, &c. And it has been suggested, that by having recourse to soiling, a greater variety of plants may be consumed, and consequently prevented from running to waste. Also, that if the consumption of plants be an object principally regarded, it is obvious that the benefits thence derived will be very great, as experience has clearly proved that cattle will eat with avidity many plants, if cut and given to them in the house, which they never will touch while growing in the field; such are the dock, cow-parsley, thistles, nettles, and numerous other plants. But to whatever circumstance this may be attributed, the fact is, that the animals will eat them without exhibiting any marks of dislike or reluctance, even when they are not pressed by hunger, and they often greedily devour such plants, as soon as they are brought in from the field, and before they can have possibly had time to become hungry. There are even vegetables, which, in a green state, are poisonous to cattle; but which, when cut and dried into hay or fodder, may not only be given with impunity, but are also eaten with avidity. Such as the water-crowfoot, with which, Dr. Pulteney says, the cottagers in the vicinity of Ringwood, on the banks of the Avon, almost entirely support their cattle; and so eagerly do these animals consume it, that they deem it unsafe to allow them more than a certain quantity. Cows indeed are asserted to be so peculiarly fond of this vegetable (which keeps them in good milking condition), that, exclusive of the scanty pittance which they obtained on an adjacent heath, *see* cow

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and one horse did not consume more than half a ton of hay in the course of a year. Thus it is evident, that fewer plants will either be rejected, or suffered to run up to waste. And that it is further well known that many of the best and finest grasses, which, when young, form a most palatable food to cattle, are, if once suffered to get into ear, so much disliked by them, that the beasts will never taste them unless compelled by extreme hunger. And, as in most pastures many of these grasses get into ear from various causes, their produce is of course inevitably lost to the farmer; whereas, if cut down by the scythe in proper time, not one plant will be suffered to get into that nauseating state, and consequently no waste be sustained on this account. Also, that, in addition, those few plants which are totally disregarded by one class of animals, so as to be rejected by them even in the house, will not, on that account, become less acceptable to others, but greatly the reverse. Thus grass, or other food that has been *blown* or *breathed upon* by any animal for a considerable time, becomes unpleasant to other beasts of the same species, but not so to stock of another class or variety, as for them it appears to acquire a higher relish. Even greater defilement by one animal seems to render food more acceptable to others; for straw, which in a clean state has been refused by cattle, if employed as a litter for horses, acquires for the former such a relish, that they seek for it with avidity. Hence it happens, that the sweepings of the stalls from one animal supply a pleasing repast for those of another kind, which can be easily removed from one to the other, if the plants are consumed in the house, but which must otherwise have been lost in the field.

This is a practice which is also recommended by the food being consumed with much less waste, consequently going much further than when fed upon the land; by the great increase of good manure that is produced; and by that of the stock feeding with less interruption and inconvenience, from their being more effectually shaded from the excessive heat of the sun, and better protected from the attacks of flies and other insects. In all these respects it would seem to have a great superiority over that of letting the animals range over the pastures or other grass lands. One great and principal objection that has been opposed to this plan of feeding, is that of the expence of conducting the business being too considerable. But the extensive trials of Mr. Mure and Young, and other cultivators and promoters of the practice, fully shew that it may be executed at an expence that can never form any real objection to it. It has likewise been contended, in opposition to this practice, that such parts of the live-stock as are in milk do not afford it so abundantly as when fed in the pastures, but which is probably a mere supposition, as it has been almost invariably found that most of the green crops that are cut and employed in this manner have greater effect in exciting that secretion than the common pasture-grass. But as particular sorts of vegetables, as well as other substances, act more powerfully on some of the glandular organs than others, it is probable that some kinds of plants may have a greater tendency to promote this kind of secretion than others, and on this account, cows fed on one sort of food in this practice may afford less milk than on others.

Farther, it is a process of feeding that has also been opposed, on the idea that animals do not thrive so well as when grazed in the pastures. It is, however, well remarked, that the more quiet and free from disturbance cattle are kept, the better they thrive and improve in their flesh. It is not probable that green food, when properly consumed in the sheds of a farm-yard, will be less advantageous in promoting the growth and fattening of stock,

than when eaten in the field, when exposed to the great heat and constant attacks of flies, and of course kept in a continual state of restlessness and inquietude. Besides, in experiments to which we might refer, the cattle were found to go on better than stock of the same kind, fed in the pastures in the most favourable seasons for the purpose. And this is further supported by trials carefully made, and detailed in the Annals of Agriculture. This notion does not, therefore, appear well supported by facts, or to have had any foundation in the experience of farmers in general.

But its superiority in respect to the economical consumption of the food cannot be disputed. In numerous experiments made in proof of the great saving in this way, it has been found to go from twice to four or five times as far as when fed on the land; and in some trials, much more. Mr. Close found that with grass, clover, lucern, and tares, three times as many cattle were capable of being supported in better condition than in the pasture mode of feeding; and with other experimenters it has been found equal to five or six times as many. The author of a late work has remarked, that in the field it is obvious that great waste must be committed by the grass being trampled down, dunged upon, and in many other ways, especially where a great number of cattle are pastured together, most of which are avoided in the stall method.

It has been, however, stated, that it is an error to suppose that all the waste is in feeding in the field, and none in the stall: there is, on the contrary, a waste in soiling; as in cases where the tares become podded, from the butt ends of the plants being coarse, and in a state of decay by lying on the ground, and, of course, rejected by the animals. The same thing also occurs with lucern, when in full blossom. Also, in the heating of the food, by its remaining heaped together, loss may likewise be sustained in some instances; but it should mostly be consumed quite fresh in this practice, and no more cut than is necessary for the day.

However, whatever the waste in these different ways may be, various trials detailed in the Annals of Agriculture clearly prove, that a greatly increased stock may be kept upon the same extent of land in the soiling method, over that of the grazing of the cattle in the fields where the plants grow.

But the most interesting circumstance in which this practice excels that of pasture feeding is, however, in the immense quantity of excellent manure that is raised and provided for the production of increased crops of various kinds, and the additional improvement of the lands. It has been well remarked, that this is a method admirably calculated for producing an abundance of manure; as from the great increase in the urinary discharges, in the consumption of green food in this way, and the heat of the season, the littering material, whatever it may be, is speedily converted into manure; by which means, with proper attention, vast stores may consequently be raised, where there would otherwise be none; which is a circumstance of the greatest importance, and which abundantly shews the great utility and superiority of the practice. By these means, the summer produce in manure may probably be made to exceed that of the winter, and at the same time be superior in quality; as there is reason to suppose that the manure produced by any kind of cattle fed in the same way, when not in a state of fattening, is much better in the summer than in the winter season. The proportion of valuable manure that the careful farmer may be capable of providing, by this system of management, is scarcely to be conceived, except by those who have been in the actual practice of it. In this view, it is of much importance to have reservoirs for the reception of the
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urine, in order that it may be occasionally thrown up over the litter, and thereby promote its speedy conversion into manure. The manure afforded by fattening animals, such as hogs and neat cattle, is in all seasons of a rich and valuable quality.

But in order to ensure the fullest benefit and advantage from this system of management, the most strict attention is necessary to different circumstances: such as those of having convenient sheds and yards for the purpose; providing suitable crops in proper succession, to the proportion of stock to be kept; the feeding and managing the animals in a proper manner; and the making a full provision of the materials, for the purpose of littering down the stalls or farm-yards. And further, in this system of management, much depends on the convenience of the yards and sheds, in respect to the economy of labour in feeding the cattle, as well as making of manure: it is, of course, necessary to have them upon such plans as may afford the greatest advantage in these ways. It has been suggested by some, in order to save the labour and expence of cleaning and feeding in this system, to have the cattle left loose in the yards, so as to consume the food from racks or cribs; the bottoms of the yards being prepared by marle, or other similar materials, and a coat of litter applied, so as that the urine may be absorbed, retained, and contribute to the conversion of them into manure. But a superior plan is probably that of having them tied up in stalls, in sheds for the purpose; as, although something may be gained in the former mode in the labour of cleaning, the latter has considerable advantage in the goodness of the manure, and in the animals being kept more quiet, and less exposed to disturbance from insects of different kinds. In the former of these modes, the stock should be sorted, and those of the same age or size fed together.

In the experience of Mr. Clove, it was found advantageous to soil horses in cheap thatched sheds, in which they have room to walk and roll; and with bullocks and cows, in stalls seven feet wide, each stall holding two fastened by the necks to the sides, by which they are prevented from inconveniencing each other while feeding.

In this method of management, it is not unlikely that great benefit might be produced by having low sheds fixed up round the yards, or other places, with suitable contrivances for the cattle receiving the food from, so as to cause the least possible loss; and by having the stock in all cases properly sorted, in regard to size, kind, and strength. Such sheds might, in some instances too, be provided, with very great utility and convenience, near to the grounds whence the food is raised and procured. In this way, a great saving of labour and expence would necessarily be made in different situations.

In all the cases where low sheds are made use of in this intention, there ought to be proper drains formed for conveying the urine and other fluid matters into the littered yards, and other places designed for forming manure, so that they may have a constant operation in the preparation of it.

It may also be necessary and beneficial, in this practice, sometimes to have different sets and sorts of animals, in order that the refuse of the food left by one set may be eaten by another, and no kind of loss sustained.

But in order that this business may be conducted in the most beneficial manner, it is necessary the farmer should carefully attend to the culture of such green crops as have been mentioned above, and which can be best applied in this way, on a scale fully sufficient for this purpose. In the

view of early application, a full proportion of lucern should be raised on the most deep and fertile soils; and on the better sorts of land, that may be in the condition of fallow, clover and tare crops may be grown. These must be sown so as to come into use at different times; the first crop of winter tares succeeding to the early cut lucern; the later put in winter tares following, after which the clover will most probably be ready, to which the third crop of tares and the second cut of lucern may succeed: at a still later period the spring tares may be employed; and in succession to this, the third cutting of lucern will in general be ready. But there are many other plants that may perhaps be made use of in this way, as chicory, which may be had recourse to with advantage in this management; as in soils that are tolerably fertile, it will admit of repeated cutting. With these different crops there will probably be seldom any necessity for the use of common cut grafs; though this may be employed, if there should be occasion. The proper foddering of the animals in this practice is a matter of great consequence. It is observed in the Annals of Agriculture, that one great object is never to suffer them to have too much at once; as when this is the case, from the heat of the season, it quickly takes on a degree of fermentation, and is rejected or only picked among by the cattle, in consequence of which much waste may be committed, which would otherwise be avoided; and in addition, it is not improbable but that the stock may thrive better by having their food more frequently, and of course in a more fresh state. But it should never, on any account, be left packed in the carts for any length of time. The best mode seems to be that of adapting the size of the cart to the exact consumption of the stock; as in this way, the whole may be conveniently distributed in the cribs or racks at once, the moment it is wanted, before it becomes unpalatable by fermentation, and the least possible loss may be incurred. It is constantly necessary to watch the conduct of labourers in this particular, as they are in general much disposed to over-feed. And there is another matter which should not be disregarded, which is that of not suffering the crops that are used in soiling to advance to too great a head; as by attention in this respect, the food may be more cleanly eaten up and consumed.

However, it must be observed, a late writer says, that in this system litter becomes an object of the greatest importance, as the large quantity of urine that is made by cattle, when soiled on these luxuriant sorts of green food, is capable, by its moistening property, of aiding in the hot season, the more quick fermentation of such materials, and of reducing a very large proportion into the state of manure. In this view, the attentive farmer should, therefore, make an abundant provision, in the winter time, of other sorts of materials, where a proper supply of straw cannot be reserved for the purpose. There are various matters that may be made use of in this intention, such as stubble, fern, rushes, and other aquatic plants, which may be cut and raked together in the places in which they are most abundantly produced, in order to be stacked up for future use. Leaves might also, in windy situations, be useful for the same purpose. And in addition to these vegetable matters, there are other substances that are capable of being employed with utility, such as peat or bog earth, fresh vegetable mould, sand, and the scrapings of roads; as during the decomposition of the various vegetable materials made use of in this practice, not only much hydrogen and carbonic gas are set at liberty, but ammonia is formed in large quantities, in the manner that has already been explained, which, from
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its action upon such earthy materials, is highly useful in bringing them into the state of manure for the improvement of lands. See MANURE.

Some other sorts of matters might likewise, in different situations, be employed in this manner with considerable benefit; such as saw-dust, when to be procured in large quantities; and the refuse materials of different manufactories, as the weld of the callico-printer, the bark of the tanner, &c. Many of these kinds of substances are excellent for the purpose of manure.

And in support of the advantages of this management, various facts have been stated by writers on farming. It is remarked by the Rev. Mr. Duncan, in the fourth volume of Communications, that he always keeps his work-horses on red clover through the summer; and they are as healthy and fit for labour as any of his neighbours', that are turned out into the pasture. Last year he cut the clover three times, and thirty falls or perches yielded as much as one horse was able to consume. He has frequently intended to try a crop of goose-grass for hay, upon some piece of ground which was not to remain in pasture; but he has always met with some avocation, at the time when the feed of this grass could be procured. He is surprised that goose-grass has been so long neglected, nay despised. It is considered as a weed among rye-grass, though he has observed that the horses are not of the same opinion. Its hay is most substantial, and were it allowed to come to maturity, its seed would, he supposes, be little inferior in weight to oats, and would probably be an excellent substitute for them in the food of horses. And it is added, that he who can procure 200 carts of dung, from the same extent of ground where 100 only were formerly produced, certainly possesses a double power of improving it. A great reserve of straw is necessary for litter to horses, when living on red clover. When the straw fails, some bed their horses with dried rushes; but rushes contribute very little to the manufacture of dung. When fern, or, as it is sometimes called, the "braken," can be gotten, he would recommend it as next to straw for littering of horses or black cattle, and as the best of all laud vegetables for the dunghill.

Mr. Rawson in the same work also highly approves of, and has long practised, the feeding of horses and spring cattle in summer upon clover; he has found that an acre of clover, cut and carried to the cattle and horses in their hovels and stalls, will maintain double the quantity of stock to an acre pastured; besides the very great quantity of manure produced by this mode of feeding, which secures almost to a certainty the turnip crop.

Also in a trial made by Mr. Mure in soiling bullocks with winter tares, as stated in the Annals of Agriculture, the advantages of this practice over that of feeding in the pastures is very fully shewn. The same system of soiling has been practised with advantage by many others, as Mr. J. Wright, &c.

The same system has been carried to a far more considerable extent, and with a new and quite different object, at the callico-printing works at Bannister Hall, near Preston, in the same county, under the direction and management of Charles Swainson, esq. Here the soiling with tares and clover is practised with a view of procuring the pure dung of the cattle which is so useful and necessary in this sort of printing business, as well as for the common purposes, and producing a large supply of milk. The system is practised to the extent of twenty-five cows and six horses, by which a prodigious saving of expence in the raising and providing of dung is made, as well as in the procuring of hay; while

the appearance and condition of the cattle are far better than in the usual methods of managing them.

The horses are some of them soiled upon and consume the refuse food from the cows, so that nothing is wasted or lost. The team-horses are kept in the stable, the others in a small enclosure, eating their food out of racks. The litter employed is the weld which has been used in dyeing, but very little of it is used, as the pure dung of the neat cattle is a material object.

The cows are bound up in sheds or cow-houses, and kept properly supplied with these sorts of green food, in consequence of which they give large quantities of excellent milk. They are kept constantly soiled in this way during the summer, except while they are consuming the after-grass of the meadows. And it is only the trouble and attention which are required in raising and providing other kinds of green food for winter use, which is wholly incompatible with large works, that have prevented the same practice in feeding from being followed during the winter season, as the great superiority and advantage of green food over that of dry in the milking system, as well as the raising of pure dung, are well understood.

The cows, though confined to the house during the whole of the day, are let out once or twice in that time for the purpose of exercise and water, but drink little under the soiling practice. There is often much advantage in varying their food, in the quantity of milk which is afforded. Cows, when tired of clover, will greedily devour tares, and these last when podded are found to be most excellent food in the view of producing milk. The same variety may likewise be equally beneficial in the use of other sorts of crops.

It is considered as of material importance in this practice with milch cows, that they are kept cool and in the shade.

Sir Humphrey Davy thinks, that in feeding cattle with green food, there are many advantages in the practice of soiling, or supplying them with food, where their manure is preserved, out of the field; the plants, it is conceived, are less injured when cut, than when torn or jagged by the teeth of the cattle, and no food is wasted by being trodden down. The cattle are likewise obliged to feed without making any selection; and in consequence the whole food is consumed: the attachment or dislike to a particular kind of food exhibited by animals, affords, it is supposed, no proof of its nutritive properties or powers, as cattle at first refuse linseed cake, one of the most nutritive substances upon which they can be fed. See STOCK, *Choice of Food in*.

Many statements, which the nature of our work does not allow our inserting, sufficiently prove the great benefits which may be derived from a more general introduction of this practice in all cases where it can be had recourse to, which are probably much more numerous than are commonly supposed; as in all places where there are lands proper for the purpose of raising the necessary sorts of green crops, it may be resorted to in the most successful manner. The great causes which have retarded and prevented the spreading of the soiling system of management would seem to be the fear of the great expence of labour that attends it, and the taking of farmers out of their usual methods of cattle feeding. The former has, however, been shewn to be a mere nothing when compared with the number of animals; and the latter obviously deserves no attention whatever. It is not improbable but that great benefit might also arise in many instances from soiling other sorts of animals in this way; such as sheep, hogs, deer, &c. as vast quantities of manure would be produced, and at the same time the animals

imals be kept in better order, and afford greater improvement and profit.

This is a method of practice that has been found, by the most exact trials, to answer perfectly both with horses, neat cattle, and swine; and with cows it has been found very beneficial in the trials of Mr. Curwen and several others, as well as in other instances. See SWINE and TEAM.

The writer of the corrected account of the state of agriculture in the county of Middlesex has, however, observed, in opposition to this system of management, that though "it has lately been suggested by several writers, that carrying grafs into the yards, and giving it to cattle there, is more adviseable than permitting them to collect their own food: where the party can manure half his land annually, or the whole every second year, it may, it is supposed, be expected to support such a high degree of exhaustion; but in other cases, the pasture would soon be so much impoverished, as to produce nothing for the owner of it to mow. Meadows which can be flooded by art at any period of summer, would probably, too, it is thought, admit of having their produce continually carried off: in all other cases, such a system would, in the opinion of the writer, in a short time ruin the land."

But surely no rational or consistent practical agriculturalist ever inculcated the necessity or utility of the practice of mowing and carrying the grafs of pasture or hay-lands to be consumed in the farm-yards by cattle. The system of useful soiling, so far as it is known to us, has been usually confined to luxuriant crops of the artificial grafs kind, raised by means of tillage, and provided for by the increased quantity of manure which is produced and preserved in the process or practice.

"The increased labour and expence of such a practice would also, it is said, render it unprofitable; one man employed in that manner, with a horse and cart, could not attend the cattle, and bring in the produce of many acres, though it would cost a grazier in this county, annually, it is supposed, one hundred and thirteen pounds; to which ought to be added, that the manure would be wasted in such a manner, as to lose a large moiety of it; in all which ways one hundred and twenty pounds would be expended, which is a greater sum than this practice is calculated to repay."

It is evident, however, from what has been seen above, that one man can not only attend to the cattle, but convey the produce of many acres to the places where it is to be eaten, besides doing much other work; and as to the horses and carts which are necessary, as those of the small kind are commonly the most suitable, they will be found on almost all farms where such a method of cattle management can be had recourse to with any benefit. Such an imaginary charge, therefore, seems to be founded on no just grounds. And that there would be any great deal more waste of manure in this than in other ways, is probably a mere supposition, as under good management, evaporation in hot seasons would be guarded against, and the accumulation of it in the practice is universally allowed to be extremely great. There is consequently no well-founded reason for concluding that the practice will not amply repay every expence attending it when properly carried on.

"The only advantage which it promises is, it is said, to avoid the damage done by the treading of cattle: it must be admitted, that in wet seasons and deep grafs this is considerable: but a few additional acres would, it is believed, supply a similar quantity of herbage at a less expence; where that cannot be obtained, reducing the number of cattle would, it is said, have the same effect, and might be done

without incurring so great a diminution of profit as the foregoing one hundred and twenty pounds would certainly be.

"It is obvious, (the writer says, after stating other objections,) that this is one of the closet systems of supporting cattle, which cannot be reduced to practice beyond the extent of a very few acres, and only then, when it can be done without any additional men or horses. If the expence of the men and teams is to be brought into the account, it will, it is said, be altogether unprofitable. Such an expence would, in this county, amount, it is supposed, in fifteen weeks, to thirty-four pounds ten shillings; which, divided by the number of acres (ten), proves the charge to be, on each acre, three pounds nine shillings; or divided by the number of oxen (six), it would be, on each, five pounds fifteen shillings: add this extra expence, it is said, to a long list of usual and unavoidable charges, and it will swell the account to such a sum, as would exceed the value of the improvement of any cattle whatever."

The system of soiling animals can clearly be extended to more than a few acres, and even where additional men and horses are required, though there will be seldom any occasion for them in the practice. Nor is the expence of the men or teams employed about it any real objection, when justly and fairly calculated, or even that of the cattle *per* head of any account, so as to make it more than equal to their advancement in condition. Where no sufficient data are given, from actual trials, it is easy to arrive at conclusions; but the practice and experience of farmers in the best cultivated districts, set all such opinions and conclusions at naught.

SOINI, in *Geography*, a town of Sweden, in the government of Wasa; 70 miles E. of Wasa.

SOINIDRO, a town of the island of Cuba; 75 miles E.S.E. of Havanna.

SOJOURNERS, among the *Athenians*, were permitted to dwell in the city, and follow their own business, without disturbance, provided they observed all the laws and customs of the country; but were allowed no share in the government. However, they were not allowed to act any thing, or manage any business in their own names, but were obliged to choose out of the citizens one, to whose care and protection they would commit themselves, whose duty it was to defend them from all violence and oppression. He was called *prostates*.

SOJOWIZ, in *Geography*, a town of Bohemia, in the circle of Boleslau; 4 miles S. of Benatek.

SOISSONS, a town of France, and principal place of a district, in the department of the Aisne, seated on the Aisne. Before the revolution it was the see of a bishop, suffragan of Rheims, and the capital of a district, called "Soissonnois." In the time of Cæsar this town was considerable, and called "Noviodunum." It afterwards took its name from the Sueviones, who were among the last that remained subject to the Romans. At the death of Clovis I. his son Clothaire made it the place of his residence, 6½ posts N.W. of Rheims. The place contains 8189, and the canton 14,839 inhabitants, on a territory of 125 kilometres, in 20 communes. N. lat. 49° 23'. E. long. 3° 20'.

SOIT *fait il comme d'siré*, be it done as it is desired; a form used when the king gives the royal assent to a private bill preferred in parliament.

SOITA, in *Ancient Geography*, a town of Asia, in the Greater Armenia. Ptolemy.

SOITO *de Rebordois*, in *Geography*, a town of Portugal, in the province of Entre Duero e Minho; 6 miles N. of Barcelos.

SOK, SOKE, *Soc*, in the *Ancient Customs*. See Soc.

The word is sometimes also used for the privilege of tenants excused from customary impositions.

Also for a quit-rent, or payment made to the lord by his tenant, for acting in quality of *soc-man*, or freeholder. See *SOCAGE*.

SOKALLEN, in *Geography*, a town of Russian Lithuania; 9 miles S. of Ragnit.

SOKASPOGE, a town of the state of Georgia; 4 miles N.E. of Oakfuskee.

SOKE, in *Rural Economy*, an ancient term, used to signify the privilege of mills, &c. By it the lord, in certain cases, was enabled to raise a considerable rent.

SOKE-Mill, that kind of mill which belongs to the lord or superior of the manor, and at which all the tenants, and sometimes the whole parish, are bound to grind their grain. Mills of this nature were once very common, and they exist still in a few places.

SOKELY, in *Geography*, a town of Norway, in the province of Bergen; 24 miles S.W. of Romfdal.

SOKEMANS. See *SOCMEN*.

SOKER, in *Geography*, a small island in the Red sea; 3 miles E. of Dsjabbel.

SOKE-REEVE, in our *Old Writers*, the lord's rent-gatherer in the *soke*, or *soken*.

SOKHIO, in the *Materia Medica*, a name used by some authors for a peculiar species, if it may be so called, of the lignum aloes.

It is of a greyish colour, and seems to have been the blea, or outer part of the wood next the bark.

SOKO, in *Geography*, a district of Africa, on the Gold Coast, extending about a league along the sea-coast, on the borders of the river Volta. The land is fertile, but the inhabitants are poor, and employ themselves chiefly in fishing.

SOKOLMA, a town of Poland, in Volhynia; 12 miles N. of Luckow.

SOKOLOW, a town of Poland, in Podolia; 54 miles N.W. of Kaminiac.

SOKOLOWKA, a town of Austrian Poland, in Galicia; 20 miles S. of Lemberg.

SOKOLVOD, or **KNEZDO**, a mountain of Croatia; 32 miles E. of Bihacs.

SOKOR ZOK, a town of Armenia, situated on a small hill, equally distant from Betlis and Diarbekir, governed by a powerful, independent, and hereditary prince, who has under his orders many different tribes of Kurds, Yezedis, and Turkomans, of a martial and barbarous disposition, and who, it is said, can bring an army of 20,000 men into the field. The climate of this place is less severe than that of Betlis; the districts are extensive, and covered with villages, but the population of the town does not exceed 6000 souls. South of Zok is the town of Sahert, or *Serud*; which see.

SOKOTKA, a town of Lithuania; 15 miles S.W. of Grodno.

SOL, a syllable in the first elements of vocal music, which, in major keys, always implies the 5th above the key-note: as, *do re mi fa sol*; or *do—sol*.

SOL, or *Sou*, *Shilling*, in *Commerce*, a French coin, according to the old system, which prevailed before the revolution, of billon, *i. e.* of copper with a little silver mixed, equal to twelve deniers, or French pence, or four liards; and the twentieth part of the livre Tournois, or pound. See *SHILLING*.

The word is formed from the Latin, *solidus*, a shilling. Bodin is mistaken when he derives it à *sole*, by reason of the sun struck on it.

The fol was first struck on the foot of twelve deniers Tournois, whence it was also called *douzain*, a name it afterwards retained, though its ancient value was changed; the fol having been since augmented by three deniers, and struck with a puncheon of a fleur-de-lis, to make it current for fifteen deniers. Soon after the old fols were coined over again, and both old and new were indifferently made current for fifteen deniers. In 1709, the value of the same fols was raised to eighteen deniers. Towards the latter end of the reign of Louis XIV. the fols of eighteen deniers were again lowered to fifteen. The fol of fifteen deniers was called *sol Parisis*. According to the old system, the silver coins in France were the *ecu*, or crown of six livres; the *petit ecu*, or half-crown (also called *ecu*) of three livres: pieces of twenty-four, twelve, and six fous; also pieces of two fous and six liards, or one and a half fou, containing five parts of silver to nineteen of copper; and pieces (entirely copper) of one fou, two liards, and one liard, or twelve, six, and three deniers. The piece of twenty-four fous, compared in fineness with the English standard of 11 oz. 2 dwts., is W. 0 dr. 7 dwt., its weight 3 dr. 20 gr., its content in pure silver is 83.4 gr., and its value in sterling is $11\frac{1}{4}d$. The pieces of twelve and six fous are in proportion. The piece of thirty fous of 1791 is W. 3 oz. 8 dwt., its weight 6 dwt. 12 gr., its contents in pure silver 100.2 gr., and its value in sterling $1s. 2d$. The piece of fifteen fous is in proportion.

In old authors we read of gold fols, which were different at different times. In the time of the Salic law, the gold fol was forty deniers; and thus it continued till the time of king Pepin, when it was reduced to twelve. Some have also imagined, that the French had anciently silver fols.

The Dutch have also two kinds of fols: the one of silver, called *fols de gros*, and likewise *schelling*; the other of copper, called also the *stuyver*. See *COIN*.

The fol, or fou, is also a money of account and copper coin in Switzerland.

SOL, in *Astrology*, &c. signifies the sun. Sol in Aries, &c. See *SUN*.

SOL, *Sun*, in *Chemistry*, is gold; thus called from an opinion that this metal is, in a particular manner, under the influence of that luminary.

What should have been the principal inducement of torturing this metal, with so much violence, to obtain from it some medicinal virtues, Dr. Quincy observes, is not easy to be guessed.

Most, indeed, acknowledge, that gold in substance, or reduced into the smallest particles by the hammer, as in the leaf-gold, is not digestible in the stomach, so as to be transmitted into the blood, and be of any efficacy there. But there are nevertheless many, who are confident of its doing extraordinary matters, if reduced into a powder, by amalgamation with mercury, and by evaporating the mercury afterwards.

Zacutus Lusitanus is one of the smartest pleaders on this side the controversy, against Musa, Picus Mirandola, and Platerus; who, besides many instances of its efficacy, urges the authority of Avicen, Serapion, Geber, and many of the Arabian physicians, with those of other countries, and of later date. Quercetan, Schroder, Zwelfer, and Etmuller, with many other more modern practical physicians, have fallen into the same opinion. But which side soever is right, the present practice rejects all pretensions to medicines from it. See *GOLD*, in *Medicine* and *Chemistry*.

SOL, in the *Hermetical Philosophy*, signifies sulphur.

SOL,

SOL, in *Heraldry*, denotes *or*, the golden colour in the arms of sovereign princes.

SOL GALICZK, in *Geography*, a town of Russia, in the government of Koltrom; 96 miles N.N.E. of Koltrom. N. lat. 59°. E. long. 42° 24'.

SOL VITCHEGODSK, a town of Russia, on the river Vitcheга; 36 miles N. of Utiug. N. lat. 61° 30'. E. long. 46° 14'.

SOLA, a small island in the Caribbean sea; 30 miles E. of Margarita.—Also, a small island among the Philippines, near the S. coast of the island of Luzon. N. lat. 13° 22'. E. long. 12° 46'.

SOLA, LA, Pylstari's Islands, so called by Maurelle. See **PYLSTART**.

SOLÆUS, in *Anatomy*. See **SOLEUS**.

SOLAGNA, in *Geography*, a town of Italy, in the Trevisan; 5 miles S. of Cismè.

SOLAGUR, a town of Bengal; 25 miles W.N.W. of Silhet.

SOLAKI, a town of Dagestan; 60 miles N.N.W. of Derbend.

SOLAN, a town of Africa, in Cashna. N. lat. 16° 30'. E. long. 10°.

SOLANA, in *Ancient Geography*, a town of Asia, in Serica. Ptolemy.

SOLAND, or **SOLAN-Goose**, in *Ornithology*. See **PELECANUS Bassanus**.

SOLANDER'S ISLAND, in *Geography*, an island in the South Pacific ocean, near the S. coast of New Zealand, discovered by captain Cook in March 1770; and so named after Dr. Solander. It is merely a barren rock, about a mile in circuit, remarkably high, and lying full five leagues distant from the main. The shore of the main lies nearest E. by S. and W. by N., and forms a large open bay, in which there is no appearance of any harbour or shelter for shipping against S.W. and southerly winds: the surface of the country is broken into craggy hills of a great height, on the summits of which were several patches of snow; it is not, however, wholly barren, for wood was seen not only in the vallies, but upon the highest ground; but it exhibited no signs of being inhabited. S. lat. 46° 31'. W. long. 192° 49'. Hawkesworth's Voy. vol. iii.—Also, a small island in the Mergui Archipelago. N. lat. 10° 39'.

SOLANDERS, in *Farrery*. See **MALANDERS**.

SOLANDRA, in *Botany*, was originally destined by the younger Linnæus, to preserve the memory of his friend Dr. Daniel Charles Solander, F.R.S., so well known in England as the companion of sir Joseph Banks, in his voyage round the world, and afterwards one of the librarians of the British Museum. He was intimately connected with the most eminent cultivators of natural science here in England, especially **ELLIS** (see that article); being no less esteemed for his polite and agreeable manners, than his extensive knowledge. He died of an apoplexy, in 1782, aged 46. His learned botanical manuscripts remain in the Banksian library; his premature decease having prevented his finishing, for publication, any considerable work, though his information enriched every thing that appeared in this country during his residence here. The great Linnæus, who justly considered Solander as one of his ablest pupils, had named a *Solandra* in the 6th edition of *Gen. Pl.* but this was subsequently referred to *Hydrocotyle*. The genus we are now to describe, must be considered as first published, by being represented on the honorary medal struck in Sweden soon after Dr. Solander's death; and thus it takes place of the less certain and ornamental *Solandra* of Murray, in Linn. Syst. Veg. ed. 14. 623, not published till 1784.—Swartz in Stock. Transf. for 1784.

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300. t. 11. Ind. Occ. v. 1. 386. Schreb. 793. Willd. Sp. Pl. v. 1. 936. Mart. Mill. Dict. v. 4. Salisb. Tr. of L. Soc. v. 6. 99. t. 6. Ait. Hort. Kew. v. 1. 388.—Clafs and order, *Pentandria Monogynia*. Nat. Ord. *Luridæ*, Linn. *Solaneis affine*, Juss.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, tubular, angular, with from three to five lanceolate, erect teeth, sub-frequently more deeply separated, permanent. *Cor.* of one petal, thrice the length of the calyx, funnel-shaped; tube inflated and bell-shaped in the upper part, five-ribbed; limb in five roundish, spreading, reflexed, wavy, partly doubly crenate, lobes. *Stam.* Filaments five, thread-shaped, declining, the length of the tube, inserted into its middle part; anthers terminal, versatile, somewhat pyramidal, of two cells. *Pist.* Germen superior, oval; style thread-shaped, declining, longer than the stamens; stigma obtuse, compressed, slightly two-lobed. *Peric.* Berry oval, pointed, smooth, of four cells. *Seeds* very numerous, kidney-shaped, imbedded in pulp, inserted into a four-branched receptacle.

Ess. Ch. Calyx tubular, splitting. Corolla funnel-shaped, inflated, irregular; limb in five rounded, reflexed, unequal segments. Berry of four cells, with many seeds.

1. *S. grandiflora*. Great-flowered Solandra. Willd. n. 1. Ait. n. 1. Jacq. Hort. Schonbr. v. 1. 21. t. 45.—Native of Jamaica, where, according to Swartz, it occupies the clefts of rocks, and the trunks of the largest trees, climbing, by roots thrown out of the stem, to their very summits, from whence its long, spreading, leafy, dependent *branches* hang down very far, flowering in January and February, and ripening fruit in August. The plant was introduced at Kew by Mr. Masson, in 1781, and long known by the extemporaneous name of *Portlandioides*, given by its finder; for being treated with the usual supplies of water, and a rich soil, it grew every year luxuriantly, but never flowered, till accidentally set aside and neglected, in the dry stove. By such management it has often flowered since, and Jacquin says it ripens fruit and seed at Schonbrun. The wood is spongy. *Stem* and *branches* round. *Leaves* scattered, most crowded about the ends of the branches, reflexed, stalked, obovate, or elliptic-oblong, acute, entire, somewhat undulated, single-ribbed, slightly succulent, more or less downy, from four to six inches long; paler beneath. *Footstalks* an inch long, round, downy. *Flowers* usually solitary, terminal, nearly sessile, very large, a span long, magnificent in appearance, and deliciously fragrant. The *corolla* is cream-coloured, with a tinge of yellow; the outside often purplish, and slightly downy; the segments of the limb flaccid, partly entire, partly crenate, and waved, in an elegant manner. *Fruit* sometimes as big as a hen's egg, white, red within, of a sweet subacid taste.—The inhabitants of Jamaica know this plant by the name of the Peach-coloured Trumpet-flower. Plumier is said to have left a sketch of it, among his drawings, by the name of *Stramonium scandens, flore luteo*.

SOLANÆÆ, the 41st natural order in Jussieu's system, the 8th of his 8th class. It is thus named from the Nightshade, (see **SOLANUM**,) which is one of the tribe, and the order is nearly equivalent to the Linnæan **LURIDÆ**, see that article. We refer the reader to **GENTIANÆ** for the character of Jussieu's 8th class; and to **LYSIMACHIÆ**, **PEDICULARES**, **SAPOTÆ**, and **SCROPHULARIÆ**, for some orders belonging to it.—The *Solaneæ* are thus defined.

Calyx generally in five segments, more or less deeply separated, for the most part permanent. *Corolla* generally regular, and five-cleft. *Stamens* mostly five, usually inserted into the lower part of the corolla. *Style* solitary. *Stigma* simple, or rarely cloven. *Fruit* mostly of two cells, with many

seeds; sometimes capsular, of two valves, with a partition parallel thereto, as in the *Scrophularia*; or more frequently pulpy, with central receptacles for the seeds attached to the middle of the partition, at each side, and usually prominent, so as to separate each principal cell of the berry internally into two parts, or, by a still further imperfect subdivision, into more. *Corculum* of the seed curved, lodged in a farinaceous albumen. *Stem* herbaceous or shrubby. *Leaves* alternate; in some instances there are two floral ones from the same point. *Flowers* variously disposed, often extra-axillary, that is, placed near the side of the insertion of the leaves, not springing from their bosoms.

The first section, with a capsular or dry fruit, consists of *Celsia*, *Verbascum*, *Hyoscyamus*, *Nicotiana*, and *Datura*.

The second, with a berry, of *Triguera* of Cavanilles, which we have recently discovered to be the very identical *Verbascum Osbeckii* of Linnæus, a plant that no subsequent botanist could ever make out; (see *VERBASCUM* and *TRIGUERA*;) *Jaborosa* of Jussieu; *Mandragora* of Tournefort; *Atropa*; *Nicandra* of Adanson, which is *Atropa physaloides* of Linnæus; *Physalis*; *Witheringia* of l'Heritier; *Aquartia*; *Solanum*; *Capsicum*; *Lycium*; and *Cestrum*.

Section third contains three genera, reckoned akin to the former; these are *Bontia*, *Brunfelsia*, and *Crescentia*. With these last the true *Solandra* is, as Jussieu suspected, to be associated. See *SOLANDRA*.

SOLANILLOS, in *Geography*, a town of Spain, in New Castile; 23 miles E. of Guadalaxara.

SOLANO, a small island near the coast of Peru. S. lat. 12° 20'.—Also, a river of Mexico, which runs into the Pacific ocean, N. lat. 10° 18'.

SOLANOIDES, in *Botany*, a name given by Tournefort to the *Rivina* of Linnæus, on account of its resemblance to *SOLANUM*; which see. See also *RIVINA*.

SOLANOS, in *Meteorology*, a name given to winds, which, blowing over an extensive tract of highly heated land, become so very drying, scorching, and suffocating, as to produce dreadful effects, and are often felt in the deserts of Arabia, in the vicinity of the Persian gulf, in the interior of Africa, and in some other places.

SOLANTA, in *Geography*, a town on the N. coast of the island of Sicily, which gives name to a cape and bay: 8 miles E. of Palermo. N. lat. 38° 9'. E. long. 13° 36'.

SOLANUM, in *Botany*, an ample genus, comprising various kinds of Nightshade, and other deadly plants, along with the esculent Tomato, Egg-plant, and even the valuable Potatoe, owes its name, according to some authors, to its comforting quality, such authors supposing the word to have originated from *solamen*. This indeed might apply to the potatoe, could that possibly have been in the contemplation of those who gave the name. The common derivation *a sole*, from the sun, carries no more conviction along with it; nor can we for a moment admit the true orthography to be *Sulanum*, from *Sus*, because the plant is useful to swine. It is far more prudent to leave *Solanum* among the few ancient names whose source cannot be traced.—Linn. Gen. 100. Schreb. 134. Willd. Sp. Pl. v. 1. 1025. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 256. Prodr. Fl. Græc. Sibth. v. 1. 154. Ait. Hort. Kew. v. 1. 396. Brown Prodr. Nov. Holl. v. 1. 444. Pursh v. 1. 156. Juss. 126. Tourn. t. 62. Lamarck Illustr. t. 115. Gært. t. 131. (Lycopericon; Tourn. t. 63. Melongena; ib. t. 65.)—Class and order, *Pentandria Monogynia*. Nat. Ord. *Lurideæ*, Linn. *Solanææ*, Juss.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, cut half way down into five, erect, acute, permanent segments. *Cor.* of one petal, wheel-shaped; tube very short; limb large,

plaited, spreading, somewhat reflexed, cut half way down into five acute segments. *Stam.* Filaments five, awl-shaped, very small; anthers large, erect, oblong, converging, slightly connected, of two cells, opening each by a terminal pore. *Pistl.* Germen superior, roundish; style thread-shaped, longer than the stamens; stigma obtuse. *Peric.* Berry roundish, smooth, marked with a dot-like scar at the summit, of two cells, divided by a fleshy receptacle, which is convex at each side. *Seeds* numerous, roundish, lodged in soft pulp.

Ess. Ch. Corolla wheel-shaped. Anthers slightly connected, opening by two terminal pores. Berry superior, of two cells.

Notwithstanding the rude and irregular habit of this genus, the flowers are often so handsome as to attract much notice, and the fruit is, in some cases, very striking and ornamental. The stem is branched, herbaceous or shrubby, smooth, hairy or prickly. Leaves alternate, simple or compound, lobed, cut or entire; sometimes prickly. Inflorescence often lateral, and extra-axillary. Corolla blue, purple, white, or yellow. Fruit yellow or red, rarely black or white. The herbage is foetid, narcotic, and dangerous. Flowers without scent. Fruit often very nauseous, and in no instance eatable without dressing.

The species are disposed in three sections. The fourteenth edition of Linn. Syst. Veg. contains forty-six; Willdenow has eighty-three. Some new ones are added by Brown, Pursh, Aiton, &c. We select the following, adding several unknown to the author whose arrangement we adopt.

Section 1. *Without prickles*. Forty-four species in Willdenow; two British.

S. laurifolium. Laurel-leaved Nightshade. Linn. Suppl. 148. Willd. n. 1.—Stem arboreous, unarmed. Leaves stalked, ovate-oblong; downy beneath. Panicle terminal, repeatedly forked, divaricated. Calyx brittle on the inner side.—Native of the vast forests of Surinam; unknown in the European gardens; nor has a figure of this species appeared. The branches are woody, round and smooth. Leaves near a span in length, entire, pointed, veiny; shining, and slightly downy, above; clothed with soft depressed hairs, spreading from all the finest veins, beneath. Footstalks an inch long, rather silky. Panicle repeatedly forked and racemose, widely spreading, composed of innumerable flowers, of which the calyx only remains on our specimens, which is small, with five acute spreading segments, most hairy or bristly within. Berries black, the size of a Black Currant.

S. verbasifolium. Mullein-leaved Nightshade. Linn. Sp. Pl. 263. Willd. n. 2. Ait. n. 1. Jacq. Hort. Vind. v. 1. 5. t. 13. (S. maximæ tomentosum, spms carens, virginianum; Pluk. Almag. 351. Phyt. t. 316. f. 1.)—Stem shrubby, unarmed. Leaves alternate, stalked, ovate, densely downy, entire. Corymbs terminal, divided. Calyx with five short teeth.—Native of the West Indies, from whence Catesby communicated it to Miller. The plant is preserved in some curious stoves, and flowers in summer. The branches, stalks, calyx, and both sides of the leaves, are hoary, densely clothed with close starry down. Flowers white, with yellow anthers, far inferior in size and beauty to the Potatoe-blossom. The shallow divisions of the calyx, and the close, not shaggy, hairs of the stalks and branches, distinguish it from the *auriculatum* hereafter described.

S. inæquale. Unequal-leaved Woolly Nightshade.—Stem shrubby, unarmed. Leaves in pairs, stalked, ovate, entire, densely downy; unequal at the base. Clusters lateral, divided. Calyx of the fruit in five deep segments.—Gathered in New Granada by Mutis. The younger Linnæus con-

founded the specimen with *S. verbascifolium*, from which it essentially differs in the inequality of the two sides of each leaf, at the base, and especially in the *inflorescence*. The twin racemose *flower-stalks* spring laterally from the intermediate spaces of the branches, between the *leaves*, and two of the latter always grow together, nearly from the same point. Whether the *calyx* of the *flower* be deeply divided, we cannot, because of its woolliness, determine; but that of the *fruit* is separated into five lanceolate segments, to the very base. *Berry* the size of a red currant, besprinkled with itary hairs.

S. auriculatum. Ear-leaved Nightshade. Ait. ed. 1. v. 1. 246. ed. 2. n. 2. Willd. n. 3. (*S. mauritanium*; Scop. Del. Infubr. v. 3. 16. t. 8.)—Stem shrubby, unarmed. Leaves stalked, ovate, pointed, entire; very soft above; acute at the base. Stipulas heart-shaped. Corymbs terminal, divided. Calyx cloven half way down.—Native of Madagascar, the Mauritius, and the East Indies. A tall *shrub*, with the habit of *S. verbascifolium*, but larger; the pubescence of the *stalks* usually more shaggy; the greener upper surface of the *leaves* remarkable for a velvet-like softness; the under white and woolly. *Calyx* separated half way down into five broad segments, which are not deeper in the *fruit* than in the *flower*. The *stipulas* are often wanting, but the species is sufficiently distinct.

S. Pseudocapsicum. Shrubby Winter-cherry Nightshade. Linn. Sp. Pl. 263. Willd. n. 6. Ait. n. 3. (*Amomum Plinii*; Lob. Ic. 265. Ger. Em. 361. *Pseudocapsicum*; Dod. Pempt. 718. *Strychnodendron*; Besl. Hort. Eyf. æt. arb. t. 14. f. 1.)—Stem shrubby, unarmed. Leaves lanceolate, wavy, smooth. Umbels lateral, sessile.—Native of Madeira. One of our popular hardy greenhouse plants from Gerard's time to this day. The *stem* is bushy, a yard high. *Leaves* stalked, ever-green, about two inches long. *Flowers* few together, drooping, white, with orange *anthers*. *Fruit* scarlet, globose, the size of a small cherry.

S. diphylum. Two-leaved Nightshade. Linn. Sp. Pl. 264. Willd. n. 10. Ait. n. 4. Jacq. Ic. Rar. t. 322. Coll. v. 2. 331. (*S. americanum*, *strychnodendro accedens*, fructu medio, antè maturitatem, quasi fisso; Pluk. Phyt. t. 111. f. 4.)—Stem shrubby, unarmed. Leaves in pairs, elliptic-oblong, smooth; one smaller than the other. Flowers cymose, opposite to the leaves.—Native of the West Indies, from whence it was brought early to this country; but is only occasionally kept in itoves, rather for curiosity's sake than otherwise, being less ornamental than the last, with smaller *flowers* and *fruit*, and much more tender.

S. Dulcamara. Woody Nightshade, or Bitter-sweet. Linn. Sp. Pl. 264. Willd. n. 15. Fl. Brit. n. 1. Engl. Bot. t. 565. Curt. Lond. fasc. 1. t. 14. Woodv. Med. Bot. t. 33. Fl. Dan. t. 607. (*Amara dulcis*; Ger. Em. 350.)—Stem shrubby, twining, unarmed. Upper leaves hastate. Clusters cymose, drooping, opposite to the leaves. *Fruit* elliptical.—Native of moist bushy places throughout Europe, from Norway to Greece, flowering in summer. The branching zigzag *stems* climb upon other shrubs, and display their elegant bunches of violet-coloured *flowers*, each of whose segments has two green dots at the base, in an elegant manner. The scarlet pellucid *berries* are also beautiful, though of a bitter and dangerous quality. The *leaves* are ovate, acute, usually smooth, on long stalks, some simple, others hastate, rarely distinctly auricled. The bark and roots are said to be bitter, with a subsequent sweetness. The young shoots have been recommended, in decoction, for rheumatic and scorbutic diseases. We have sometimes doubted whether this might not be the *κικλαμινος*; *βίση* of Dioscorides, a much disputed plant: but the flowers are

neither white, nor fragrant, as he describes them. We readily concur with Willdenow in believing the Linnæan β , figured in Dill. Elth. t. 273. f. 352, to be a distinct species, nor do we doubt its being the *quadrangulare*, hereafter mentioned.

S. Seaforthianum. Lord Seaforth's Nightshade. Andr. Repof. t. 504. Ait. Epit. 374.—Stem shrubby, twining, unarmed. Leaves simple or ternate, ovate, pointed, smooth. Panicles lateral, drooping, compound. Corolla without dots.—Native of the West Indies, from whence it was brought by the late earl of Seaforth. This beautiful species is said to succeed best in a conservatory. Its general appearance resembles the last, but the large pendulous *panicles* of numerous pale-purple *flowers*, destitute of green dots, are very different, and extremely ornamental on a trellis. The *inflorescence* often seems terminal, but is properly lateral. Of the *berries* we have no information.

S. scandens. Climbing Surinam Nightshade. Linn. Suppl. 147. Amoen. Acad. v. 8. 253. Willd. n. 17.—Stem twining, unarmed. Leaves ovate; heart-shaped at the base; downy beneath. Panicle terminal, cymose. Calyx smooth on the inside.—Native of Surinam. The *leaves* betray a considerable affinity to our first species, *laurifolium*, but the downiness of their under surface consists of little, forked or itary, scattered hairs, not of simple ones proceeding in double rows from each vein. The *branches* moreover are long and flaccid, apparently herbaceous; and the *calyx* is not brittle within, but nearly smooth on both sides. *Corolla* downy, divided almost to the bottom. Lower half of the *style* hairy. *Berries* the size of a cherry.

S. quercifolium. Oak-leaved Nightshade. Linn. Sp. Pl. 264. Willd. n. 20. Ait. n. 6. (*S. foliis quernis*; Feuill. Peruv. 722. t. 15.)—Stem somewhat herbaceous, angular, zig-zag, rough-edged, erect, unarmed. Leaves pinnatifid. Clusters cymose.—Gathered by Feuillé, on the mountains of Valparaiso, in Chili. Linnæus raised the plant at Upsal, from seeds sent by Jusſieu, but it has only lately found its way to the English gardens. The *root* is thick, fleshy, and perennial. *Stem* four or five feet high, branched, leafy, with several unequal angles, that are rough, with minute sharp tubercles. *Leaves* regularly pinnatifid, of five or seven bluntish, entire, rather distant lobes, nearly smooth; their long *footstalks* slightly winged. *Flowers* drooping, violet, with yellow *anthers*; their *corolla* broader than that of *S. Dulcamara*. *Berries* red, ovate.

S. radicans. Rooting Nightshade. Linn. Sp. Pl. 264. Willd. n. 22. Ait. n. 8. Linn. fil. Dec. 1. 19. t. 10.—Stem somewhat herbaceous, unarmed, roundish, prostrate, nearly smooth, taking root. Leaves pinnatifid. Clusters cymose.—Native of Peru. Very nearly related to the last, but differing in its prostrate creeping *stem*, whose angles are less marked, and almost smooth. The segments of the *leaves* are never more than five. *Clusters* simple. *Flowers* fewer and smaller, white; purplish beneath. *Berries* yellow, globose or two-lobed.

S. laciniatum. Cut-leaved Nightshade. Ait. ed. 1. v. 1. 247. ed. 2. n. 7. Willd. n. 21. Br. n. 4. Curt. Mag. t. 349. (*S. aviculare*; Forst. Prodr. 18. Pl. Escol. 42.)—Stem somewhat shrubby, unarmed, smooth. Leaves linear-lanceolate, undivided or pinnatifid, entire, smooth. Clusters lateral, corymbose. Calyx cloven half way down. Segments of the corolla emarginate. Stamens spreading. *Berry* oval.—Native of New Zealand, New South Wales, and Van Diemen's land. A greenhouse shrub, introduced by sir J. Banks in 1772. The *leaves* are dark green, nearly sessile; sometimes quite undivided, sometimes deeply pinnatifid, on the same or a different plant; their length from

four to eight inches. *Flowers* purple, large and handsome, with rounded notched segments. *Anthers* yellow, soon widely spreading from each other. *Fruit* yellow, the size of a large plum, acid, sweetish, but with a disagreeable flavour. Forster says the inhabitants, as well as the small birds, of New Zealand, greedily devour this fruit, nor did the European voyagers entirely reject it.

S. corymbosum. Corymbose Peruvian Nightshade. Ait. ed. 1. v. t. 248. ed. 2. n. 11. Willd. n. 26. Jacq. Ic. Rar. t. 40. Coll. v. 1. 78. Retz. Obs. fasc. 5. 22.—Stem unarmed, somewhat shrubby, smooth. Leaves ovato-lanceolate, entire; tapering at the base. Flower-stalks lateral, branched, corymbose.—Found by Dombey at Lima, growing near waters. M. Thouin sent seeds to Kew in 1786, when we saw the plant flowering in the stoves at Paris, in August. Its beauty scarcely exceeds our wild *S. nigrum*. The *flowers* are copious, small, purplish. *Clusters* several together, on a common corymbose stalk, opposite to each leaf. *Berries* scarlet, the size of a small pea.

S. quadrangulare. Quadrangular African Nightshade. Linn. Suppl. 147. Willd. n. 27. Thunb. Prodr. 36. (*S. Dulcamara* β; Linn. Sp. Pl. 264. *S. crassifolium*; Lamarck Dict. v. 4. 284. *S. dulcamara africanum*, foliis crassis hirsutis; Dill. Elth. 365. t. 273. t. 352.)—Stem shrubby, unarmed, angular, rough. Leaves ovate; undivided, or with angular lobes. Panicles terminal, cymose.—Found by Thunberg, at the Cape of Good Hope. Cultivated by Sherard at Eltham, and therefore entitled to a place in Mr. Aiton's work. The figure of Dillenius is very characteristic, as to the *foliage* and *flowers*, but does not express the remarkably angular *stem*, except towards the top of the specimen. Hence it has been overlooked with regard to this plant. The *branches* in Thunberg's two specimens before us are irregularly quadrangular, very rough, with callous points and bristly hairs. *Leaves* stalked, fleshy, smooth, except at the edges, an inch or inch and half long, obtuse, ovate; either quite entire, or on luxuriant shoots, furnished with one or two large, prominent, tooth-like lobes at each side. *Flowers* larger, paler, and less expanded than in our *Dulcamara*; the points of the *corolla* hairy.

S. bonariense. Tree Nightshade. Linn. Sp. Pl. 264. Mant. 205. Willd. n. 29. Ait. n. 12. (*S. bonariense arborescens*, papas floribus; Dill. Elth. 364. t. 272. f. 351.)—Stem shrubby, nearly unarmed. Leaves ovate-oblong, wavy and sinuated, rough. Fruit half the diameter of the flowers.—Native of Buenos Ayres. Raised from seed by Sherard in 1726, or thereabouts, and now a frequent greenhouse plant, of a tall bushy habit, esteemed for its copious large white *flowers*, with orange *anthers*. The *leaves* are from three to six inches long, besprinkled with little starry rigid hairs. *Flower-stalks* corymbose, opposite to the leaves. *Berries* yellow, scarcely half an inch broad. The young *stems* are prickly in the lower part, and indeed not unfrequently in the upper, so that this species would stand better in the second section.

S. macrocarpon. Large-fruited Nightshade. Linn. Mant. 205. Willd. n. 30. Ait. n. 13. (*S. caule inermi suffruticoso*, foliis oblongo-ovatis sinuatis utrinque glabris, floribus alaribus; Mill. Ic. v. 2. 196. t. 294. *Lycopersicum arborescens*, foliis angulatis, fructu aureo; Plum. Ic. 219. t. 224. f. 2.)—Stem shrubby, unarmed. Leaves wedge-shaped, wavy and sinuated, smooth. Fruit thrice the diameter of the flowers.—Native of Peru. A stove-plant, cultivated by Miller, and flowering in summer. This is of a larger size, and stouter habit, than the last, with which Linnæus long confounded it. The *flowers* are blue; their *corolla* smaller, with more pointed segments, and the *corymbs*

less compound, than in *S. bonariense*, but the *fruit* is ten times as large, supported by a short thick stalk.

S. tuberosum. Common Potatoe. Linn. Sp. Pl. 265. Willd. n. 31. Ait. n. 14. (*S. tuberosum esculentum*; Bauh. Prodr. 89. *Battata virginiana*; Ger. Em. 927. *Papas Peruanorum*; Besl. Hort. Eyst. autumn. t. 27. f. 1.)—Stem unarmed, herbaceous. Leaves interruptedly pinnate, entire. Flower-stalks subdivided.—Native of Peru. Gerarde says he received roots from Virginia, which succeeded well in his garden. No similar acquisition was ever more important to this country. The *herbage* is annual, impatient of cold, bushy, with copious roughish *leaves*, pinnate in a lyrate form, with very small intermediate leaflets. *Flowers* paniced, large, purplish or white, drooping, very handsome. *Fruit* globose, purplish.—For the different varieties, uses, and cultivation of this valuable plant, see POTATOE.

S. Lycopersicum. Tomato, or Love-apple. Linn. Sp. Pl. 265. Willd. n. 33. Ait. n. 15. (*Poma amoris*; Camer. Epit. 821. Ger. Em. 346. Besl. Hort. Eyst. autumn. t. 1, 2.)—Stem unarmed, herbaceous. Leaves interruptedly pinnate, cut. Clusters deeply divided, leaflets. Fruit smooth.—Native of South America. A tender annual, cultivated in England ever since Gerarde's time, for the sake of its large, variously-shaped, scarlet or orange *fruit*, which many people esteem a great luxury, either in soups; or broiled with pepper and salt, as an addition to roast-meat, or game. In the hotter parts of Europe, the Tomato has more acidity and briskness of flavour, and is therefore the more welcome in such climates. It has also the reputation of being stimulant, or aphrodisiac. The *root* is fibrous. *Herb* of rank growth, weak and decumbent, fœtid, glutinous, downy. *Leaflets* acute, coarsely cut and toothed, with a double series of small stalked intermediate ones. *Flowers* yellow, in large divided bunches. *Fruit* shining, pendulous, very ornamental.—Whether Jacquin's *Pseudo-lycopersicum*, with its simple *clusters*, and small globular *fruit*, be a distinct species, we greatly doubt; see his Hort. Vind. v. 1. t. 11. Linnæus did not distinguish it. Nor have we absolute confidence even in *S. peruvianum*, Linn. Sp. Pl. 265. Willd. n. 35. Jacq. Coll. v. 2. 284. Ic. Rar. t. 327, distinguished by its bracteated or leafy *clusters*, and somewhat downy *fruit*. Its *root* indeed is perennial, and the herbage more compact, neat, and hoary, than the common Love-apple.

S. multifidum. Ragwort-leaved Nightshade. Lamarck Dict. v. 4. 287. Illustr. t. 115. f. 3, not 2.—Stem herbaceous, unarmed, winged. Leaves doubly pinnatifid, obtuse. Panicle cymose.—Gathered by Dombey, in sandy ground at Lima. The *root* is fibrous, apparently annual. *Stem* twelve or eighteen inches high, branched, spreading, leafy, bordered at each side with an entire, uninterrupted wing. *Leaves* succulent, rather downy, elegantly subdivided, decurrent; all their lobes obtuse. *Flowers* white, or purplish, several together, in long-stalked, terminal, cymose or forked *panicles*. *Corolla* but slightly divided.

S. nigrum. Common or Garden Nightshade. Linn. Sp. Pl. 266. Willd. n. 39. Fl. Brit. n. 2. Engl. Bot. t. 566. Fl. Dan. t. 460. Curt. Lond. fasc. 2. t. 14. Woodv. Med. Bot. t. 226. (*S. hortense*; Ger. Em. 339. Camer. Epit. 812. Matth. Valgr. v. 2. 415.)—Stem herbaceous, unarmed, erect. Leaves ovate, with tooth-like angles. Umbels lateral, drooping.—Native of cultivated and waste ground in all parts of the world. *Root* annual. *Stem* bushy, more or less angular. *Leaves* scattered, stalked, ovate, slightly downy; elongated at the base; either entire, wavy, or coarsely toothed, at the margin. *Umbels* lateral, not

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not quite opposite to the leaves, solitary, stalked, composed of numerous small white *flowers*, with yellow *anthers*. *Berries* the size of currants, usually black, but occasionally yellow, even in England, according to Hudson. Authors enumerate several varieties of this species, differing in the more or less angular, and somewhat crisped or toothed, *stem*, and more hairy or smoother *herbage*. Willdenow says these are permanent, but we can scarcely define the distinctive marks of each. Several of them are exhibited in Dill. Elth. t. 274 and 275.

S. angustifolium. Narrow-leaved Nightshade. Lamarck Dict. v. 4. 291.—Stem unarmed, somewhat herbaceous. Leaves stalked, linear-lanceolate, obtuse, entire, smooth. Clusters lateral, divided.—Gathered by Commerçon at Buenos Ayres. The *stem* is branched, leafy, somewhat angular, zig-zag, or perhaps rather twining. *Leaves* alternate, uniform, about two inches long, and a quarter or half an inch broad, with one rib, and a few lateral connected veins. *Flowers*, in our solitary specimen, certainly not terminal, but opposite to a leaf, in a divided *cluster*, not numerous, on long partial stalks. *Calyx* hemispherical, nearly or quite smooth, with very unequal broad segments. *Corolla* blue, half an inch wide, finely downy at the outside.

S. betaceum. Beet-leaved Nightshade. Cavan. Ic. v. 6. 15. t. 524. Ait. n. 18. Andr. Repof. t. 511.—Stem shrubby, round, unarmed. Leaves ovate, pointed, fleshy, smooth; heart-shaped at the base; wavy at the edges. Clusters lateral, stalked, divided, pendulous.—Probably a native of South America. Seeds were sent, in 1803, by Cavanilles, from the Madrid garden to the writer of this article. The plant is gigantic, twelve feet high or more, fleshy, very fœtid when touched or bruised, growing luxuriantly if turned out against a south wall in summer, but not of sufficient beauty to excite general notice. Some *leaves* measure twenty inches in length, and fifteen in breadth. The *flowers* are small in proportion, not quite so big as a potato-blossom, but more deeply divided, light purple with yellow *anthers*.

S. Melongena. Egg-plant Nightshade. Linn. Sp. Pl. 266. Willd. n. 41. Ait. n. 19. (Melongena; Camer. Epit. 820. Matth. Valgr. v. 2. 424. Mala insana; Ger. Em. 345. Fuchf. Hist. 533. Melauzana fructu pallido; Besl. Hort. Eyf. autumn. t. 3.)—Stem herbaceous, unarmed. Leaves ovate, wavy, clothed with starry down. Flower-stalks deflexed, swelling. *Calyx* mostly unarmed. Fruit ovate, smooth and even. Native of tropical climates; cultivated in various parts of the world by means of hot-beds or stoves, for the sake of its *fruit*, which resembles a large egg, and is usually of a pure polished white, though sometimes tinged with violet. It is eaten in Italy, Spain, and other warm countries, like the Tomato. We have under the article MELONGENA, traced the origin of that word, and ventured to derive from thence the frightful appellation of *Mala insana*, Mad-apples, given to the fruit in question, which it appears not particularly to deserve. The *herbage* is branched, clothed with starry, not very dense, pubescence. *Flowers* purplish, large, drooping, lateral or axillary, not many together. Segments of the *calyx* lanceolate, or nearly linear; sometimes prickly.—Gerarde says of these apples, “the people of Toledo eat them with great devotion, being boiled with fat flesh, putting to it some scraped cheese, which” (the apples) “they do keep in vinegar, honey, or salt pickle, to procure lust.”

Section 2. *Prickly*. Thirty-eight species in Willdenow; none British.

S. insanum. Prickly Mad-apples. Linn. Mant. 46. Willd. n. 45. (*S. pomiferum*, magno fructu ex albo et

atropurpureo nitente, foliis et calyce spinosis; Pluk. Phyt. t. 226. f. 3. *S. pomiferum*, fructu nigro spinoso; Morif. sect. 13. t. 2. f. 2.)—Stem prickly, herbaceous. Leaves ovate, sinuated, densely downy. Flower-stalks deflexed, swelling. *Calyx* armed with strong prickles. Fruit oblong, smooth, furrowed.—Native of tropical climates. Linnæus originally confounded this plant with *S. Melongena*, of which it may, after all, be only a thorny variety. *Troungum hortense*, Rumph. Amboin. v. 5. 238. t. 85, seems rather to belong to the *Melongena*.

S. mammosum. Nipple Nightshade or Bachelor's Pear. Linn. Sp. Pl. 267. Willd. n. 51. Ait. n. 24. Pursh n. 3. (*S. barbadense spinosum*, foliis villosis, fructu aureo rotundiore, pyri parvi inversi formâ et magnitudine; Pluk. Phyt. t. 226. f. 1. Pomum Sodomæ; Merian. Surin. 27. t. 27.)—Stem hairy, prickly, herbaceous. Leaves heart-shaped, lobed and angular; prickly and hairy on both sides. Fruit pointed.—Native of the West Indies. An annual stove-plant, which may perhaps have been frequently introduced, and soon again lost. The whole of the *herbage* is very villous, the *footstalks*, and ribs of the *leaves*, more especially, armed with formidable straight yellow thorns. *Flowers* pale blue, in small lateral clusters, with a hairy *calyx*, and large *anthers*. Fruit solitary, yellow, about two inches long, ovate with a point. Merian says it is very poisonous to men and beasts. Mr. Pursh found this species on the sea-coasts of Virginia and Carolina, its seeds, as we should suppose, having floated thither.

S. virginianum. Virginian Nightshade. Linn. Sp. Pl. 267. Willd. n. 55. Ait. n. 25. Pursh n. 4. (*S. americanum laciniatum spinosissimum*; Dill. Elth. 360. t. 267. *S. annuum nigricans virginianum spinosissimum latè se spargens*, flore cæruleo, glabrum; Pluk. Phyt. t. 62. f. 3.)—Leaves pinnatifid, with sinuated obtuse segments, ciliated, very prickly on both sides, as well as the herbaceous upright stem, the stalks, and the calyx. Fruit globose.—On road-sides, and in sandy fields, from Virginia to Carolina, flowering in July. *Pursh*. A tender biennial with us. The *root* is fibrous. *Stem* branched, erect, spreading. *Leaves* three or four inches long, deeply sinuated and cut, minutely fringed, but otherwise the whole plant is destitute of pubescence, though every where copiously armed with awl-shaped pale-yellowish thorns, sometimes near an inch long. *Flowers* lateral, distant from the leaves, simply racemose, blue. Fruit small, globose, variegated with green and white.

S. Jacquinii. Jacquin's Nightshade. Willd. n. 56. Ait. n. 26. (*S. virginianum*; Jacq. Coll. v. 2. 285. Ic. Rar. t. 332.)—Leaves pinnatifid, with sinuated obtuse segments, smooth, very prickly on both sides, as well as the decumbent, spreading, herbaceous stem, the stalks, and the calyx. Fruit globose.—Native of the East Indies, île de Bourbon, &c. Sent to Kew by sir Joseph Banks about 1804. A tender annual, flowering in September and October. Very nearly akin to the last, but the decumbent *stem*, and smooth edges of the *leaves*, are, in consideration of its oriental origin, supposed to indicate a specific difference. Some starry hairs occur on the young *leaves*, and extremities of the *branches*. The *fruit* is the size of a gooseberry, variegated with light and dark green. *S. xanthocarpum*, Schrad. Sert. Hannov. t. 2, is too nearly related to this to be considered as more than a variety.

S. fedomum. Dark-thorned Nightshade. Linn. Sp. Pl. 268. Willd. n. 63. Ait. n. 29. Sm. Fl. Græc. Sibth. t. 235, unpublished. (*S. pomiferum frutescens africanum spinosum nigricans, borraginis flore, foliis profundè laciniatis*; Herm. Lugd. Bat. 573. t. 575. Tourn. Inst.

Inft. 149. *S. pomiferum*, foliis quercus utrinque spinosis, flore borraginis; Morif. feft. 13. t. 1. f. 15.)—Stem shrubby, round, prickly. Leaves deeply pinnatifid, roundly lobed, roughish, with scattered thorns. Calyx prickly, much shorter than the fruit.—Native of Africa, and the south of Europe. A greenhouse shrub, flowering in June and July. The *stem* is erect, branched, brown or purplish, more or less roughish, like the rest of the herbage, with somewhat starry hairs, and bearing, like the ribs of the *leaves* above and below, and all the *stalks*, copious, strong, brownish, scarcely black, straight thorns, broad at the base. The *leaves* are green, very deeply, often doubly, pinnatifid, with wide sinuses, and blunt rounded lobes, like those of some American oaks. *Clusters* lateral, simple. *Flowers* large and handsome, purple, with shortish yellow *anthers*. *Calyx* very thorny. *Fruit* yellow, globose, pendulous, an inch or two in diameter.

S. Pyracantha. Orange-thorned Nightshade. Lamarck Dict. v. 4. 299. Ait. n. 30. Sm. Exot. Bot. v. 2. 9. t. 64.—Stem shrubby, very thorny, as well as the foliage and calyx. Leaves oblong, acute, pinnatifid, densely downy. *Clusters* lateral, woolly.—Native of Madagascar. Sent by M. Thouin, in 1789, to Mr. Aiton. It flowers in the stove in August and September, but, according to Mr. Lambert, succeeds well during autumn, if turned out under a south wall. The whole plant is rendered very brilliant by the copious, large, bright-orange thorns, and the downy ribs of the *leaves* are of the same rich hue. Each *leaf* is often a foot long, with spreading, parallel, acute, lanceolate, angular lobes, clothed on both sides with dense, white, starry pubescence. *Branches* and *stalks* woolly. *Clusters* simple. *Calyx* woolly, thorny at the base only; its segments linear-lanceolate. *Corolla* violet, with green branching veins. *Anthers* yellow, equal. *Stigma* simple. *Berry* globose, reddish.

S. fimbriifolium. Rocket-leaved Nightshade. Lamarck Dict. v. 4. 307.—Stem shrubby, thorny, as well as the foliage and calyx. Leaves doubly pinnatifid, acutely notched, hairy. *Clusters* lateral, with hairy stalks. *Stigma* two-lobed.—Gathered at Buenos Ayres, by Commerfon, whose specimen is before us. The *leaves* are not half so long as the last, but broader in proportion, and green, not white or hoary, their pubescence, and that of the whole herbage, being simply hairy, apparently viscid, not at all stellated. The *thorns* are slender, of a tawny or orange hue, and are extremely abundant about the base of the *calyx*. *Clusters* longer than the leaves, simple, of a few large, white, or bluish-coloured, *flowers*, whose *stigma* is capitate, of two downy lobes.

S. argentatum. Silvery-coated Nightshade.—Stem shrubby, prickly, as well as the foliage and calyx. Leaves oblong, obtuse, bluntly sinuated, clothed, like the stalks, calyx, and back of the corolla, with depressed, starry scales.—Native of Buenos Ayres. We presume this may be the supposed variety, mentioned by M. Poiret in Lamarck, with simply pinnatifid *leaves*. Probably that able botanist viewed it but slightly, for nothing can be more distinct than our plant, gathered by Commerfon, nor are many of its genus more elegant. The *leaves*, on long spinous *stalks*, are pretty exactly of the size and figure of our Common Oak, but thickly clothed on both sides with curious starry scales, rather than hairs, more dense and hoary on the under surface, and more silvery on the *flower-stalks*, *calyx*, and even the back of the *corolla* itself. The *thorns* of the whole plant are slender, and orange-coloured. The *calyx* is bell-shaped, angular, with short slender teeth; its base prickly.

S. cornutum. Horn-flowered Nightshade. Lamarck

Dict. v. 4. 308. “Juss. Annal. du Mus. d’Hist. Nat. v. 3. 120. t. 9;” *Pursh*.—Stem herbaceous, thorny, as well as the foliage and calyx. Leaves doubly pinnatifid, lyrate, nearly smooth. *Anthers* declining; the lower one much the largest.—Native of Vera Cruz, from whence Thierry de Menonville brought seeds to the Paris garden. We know not whether the *root* or *stem* be perennial or no, but the plant seems of luxuriant growth, with copious, long, slender, pale-yellow thorns. The *leaves* are green, not hairy, but roughish with minute points, at least in a dry state; the whole leaf, as well as each division, particularly the terminal one, elegantly lyrate; the ribs beset with fine bristly thorns. *Clusters* lateral, dense, with slightly downy stalks. *Flowers* large, yellow, remarkable for the great size of their lowermost *anther*.

S. heterandrum. North American Horned Nightshade. Pursh n. 6.—Stem herbaceous, thorny, as well as the foliage and calyx. Leaves doubly pinnatifid, hairy and downy on both sides; their segments obtuse. *Anthers* spreading; the lower one as long as the corolla. *Berry* enclosed in the armed calyx.—Found by Mr. Nuttall, on the banks of the Missouri, flowering in July. Annual, with large yellow *flowers*. Nearly allied to the last. *Pursh*.

S. capense. Thorny Cape Nightshade. Linn. Suppl. 147. Willd. n. 64. Thunb. Prodr. 37.—Stem shrubby, round, thorny, as well as the foliage and calyx. Prickles crowded, straight. Leaves bluntly pinnatifid, rough with starry hairs. *Fruit-stalks* lateral, in pairs, unarmed, recurved.—Brought by Thunberg from the Cape of Good Hope. The *stem* is woody, very much branched, knotty, rigid, apparently of humble stature, armed with plentiful, sharp, straight, tawny prickles, from a quarter to half an inch long; the young *branches*, and *stalks*, clothed with lax starry hairs. The *leaves* are stalked, barely an inch long, sinuated like an oak-leaf, with two rounded lobes at each side, bearing a few large prickles, and clothed all over with the same starry pubescence as the stalks, though described by the younger Linnæus and Thunberg as naked. The *flowers* we know nothing of. *Berries* globose, orange-coloured, polished, naked, the size of Black Currants, two or three together, on strong recurved *stalks*, shorter than the leaves, and almost entirely destitute of prickles, though the deeply-divided calyx bears several large ones. No figure, nor, till now, any full description, of this species has been published.

S. marginatum. White-margined Nightshade. Linn. Suppl. 147. Willd. n. 65. Ait. n. 31. Jacq. Coll. v. 1. 50. Ic. Rar. t. 45.—Stem shrubby, woolly, prickly, as well as the foliage and stalks. Leaves heart-shaped, waved or sinuated, white-edged; densely woolly beneath.—Said to have been brought by Mr. Bruce, the celebrated traveller, from Abyssinia, or at least from Africa, and introduced at Kew in 1775. Jacquin gives Palestine as its native country. This is a handsome greenhouse shrub, flowering most part of the summer, and distinguished by the pure-white margin of its rather large *leaves*, on the upper side, especially when young. The snowy, granulated, minutely starry pubescence of the whole plant, very dense on the backs of the *leaves*, is also striking. The *prickles* are small and few. *Flowers* the size of a potatoe-blossom, cymose, with purple ribs. *Calyx* woolly, unarmed, splitting unequally. *Fruit* ovate, of a dirty yellow.

S. Vespertilio. Bat-flowered, or Canary, Nightshade. Ait. ed. 1. v. 1. 252. ed. 2. n. 33. Willd. n. 67. Wendl. Hort. Herrenh. fasc. 4. 5. t. 21. (Nyctærium cordifolium; Venten. Malmaif. t. 85.)—Stem shrubby, prickly. Prickles conical. Leaves heart-shaped, undivided; woolly beneath. *Corolla*

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Corolla irregular. Lower anther greatly elongated.— Brought by Mr. Masson, from the Canary islands, in 1779. A greenhouse shrub, flowering in March and April. The upright branching stem is armed with abundance of short, straight, conical, brownish prickles. Leaves the shape and size of those of the *Catalpa*; green, besprinkled with minute starry hairs, above; densely downy, and hoary, beneath. Flowers about the size of the last, and in like manner lateral and cymose, often, if not always, four-cleft and tetrandrous, their stalks, unarmed calyx, and back of the purple irregular corolla, covered with starry down. Lowermost anther declining, ending in a long recurved beak, as in *S. cornutum* and *heterandrum*, already described, upon which character principally Ventenat founds his genus of *Nycterium*, so called from *νυκτερις*, a bat. Such a genus would differ from *Solanum* nearly as *Celsia* does from *Verbascum*, and if several more species should occur, it might, for convenience at least, be adopted.

S. tomentosum. Woolly Nightshade. Linn. Sp. Pl. 269. Willd. n. 70. Ait. n. 34. Thunb. Prodr. 36. (*S. coccineum*; Jacq. Misc. v. 2. 329. Ic. Rar. t. 43. *S. spinosum*, maximè *tomentosum*; Bocc. Sic. 8. t. 5. f. 1.)—Stem shrubby, with a few bristly prickles. Leaves heart-shaped, unarmed, wavy, clothed with dense starry wool on both sides.—Native of the Cape of Good Hope; introduced into the European greenhouses about the middle of the 17th century. A pretty species, with a zig-zag stem of no great elevation, its branches and whole herbage remarkably woolly and white, with a few scattered, minute, needle-like prickles, especially on the flower-stalks. The pubescence of the young budding leaves is usually tinged with violet. Calyx bell-shaped, cloven half way down, unarmed. Corolla purple or lilac, woolly at the outside. Fruit globose, of a beautiful scarlet, varying in size from that of a pea to a small gooseberry.

S. giganteum. Tall Snowy-leaved Nightshade. Jacq. Coll. v. 4. 125. Ic. Rar. t. 328. Willd. n. 74. Ait. n. 36. (*S. niveum*; Thunb. Prodr. 36. Vahl. Symb. v. 2. 41.)—Stem shrubby, armed with downy conical prickles. Leaves elliptic-lanceolate, acute, unarmed; smooth above; snow-white and downy beneath. Clusters terminal, forked, cymose. Fruit erect.—Native of the Cape of Good Hope. Introduced by Mr. Masson, in 1792. A greenhouse shrub, flowering in June and July, of a tall and striking habit, like that of some *Echium* or *Tournefortia*. The branches are thick and round. Prickles copious, short. Leaves numerous about the tops of the branches, from three to five inches long, stalked, recurved; dark green above; peculiarly white and soft beneath. Flowers numerous, purple, rather small, drooping, on corymbose stalks, which become entirely erect as the fruit advances.

S. rubiginosum. Rusty Nightshade.—Stem shrubby, armed, like the footstalks and ribs of the leaves, with hooked prickles. Leaves elliptical, acute; nearly naked above; downy and rusty beneath. Clusters terminal, forked, cymose. Corolla downy.—Gathered in Cayenne by Mr. Von Rohr, who sent it to Sir Joseph Banks as the *S. rubiginosum* of Richard. But we find no such name in the catalogue of Cayenne plants by this botanist, in the *Actes de la Soc. d'Hist. Nat. de Paris*, v. 1. 105. Aublet appears by his herbarium to have called this species *rhamnoides*, but it does not occur in his book. The dried specimen is distinguished by a peculiarly striking rusty tint, which may possibly not be so strong in the living plant. The branches are round, covered with brown, minutely starry, close down, and armed with numerous, small,

smooth, very sharp, strongly hooked prickles. Footstalks an inch long, angular, similarly clothed and armed. Leaves three or four inches in length, and an inch and a half in breadth, entire, with one rib, prickly in the lower part, and many interbranching veins; their upper surface green, shining, smooth and naked, except a few scattered, rigid, starry hairs, which cause a roughness to the touch; under surface marked with prominent veins, and densely covered with close, shining, rusty or whitish, soft, starry down. Inflorescence similar to the last, to which this fine species seems most akin, but the stalks, calyx, and under side of the corolla, are clothed with rusty starry pubescence. The branch is subsequently continued beyond the flowers.

S. polyacanthos. Many-thorned Nightshade. Lamarck Tabl. Encycl. v. 2. 23. n. 2377. Dict. v. 4. 304. Willd. n. 79. (*S. parviflorum*; Cavan. Ic. v. 3. 19. t. 236. *Phytolacca frutescens spinosissima, foliis angustis et crispis*; Plum. Ic. 218. t. 224. f. 1.)—Stem shrubby, very prickly as well as the foliage. Prickles long, straight, and slender. Leaves linear-lanceolate, obtuse, slightly waved, nearly sessile, hairy. Stalks axillary, single-flowered.—Native of Hispaniola, where our specimen was gathered by Thierry. The whole herbage is excessively prickly, with yellow needle-like thorns, green, rough with starry hairs, not hoary. Leaves copious, an inch and a half long, rather convex, all simple and undivided. Flowers very small, solitary, drooping, white. Berry globose, hardly bigger than a mustard-seed. Calyx unarmed.

S. igneum. Red-spined Nightshade. Linn. Sp. Pl. 270. Willd. n. 80. Ait. n. 37. Jacq. Hort. Vind. v. 1. 5. t. 14. (*S. spiniferum frutescens, spinis igneis, americanum*; Pluk. Phyt. t. 225. f. 5.)—Stem shrubby, prickly, as well as the footstalks and foliage. Prickles scattered, somewhat conical, shining. Leaves lanceolate, entire, slightly downy on both sides.—Native of South America. Cultivated for more than 100 years past in the stoves of this country, where it is most conspicuous for the little shining flame-coloured thorns, sometimes making the shrub look as if on fire. The branches are round. Leaves stalked, green, three or four inches long. Flowers white, often only four-cleft, in slender, simple, lateral clusters.

S. stelligerum. Starry Nightshade. Sm. Exot. Bot. v. 2. 57. t. 88. Brown. n. 8.—Stem shrubby, prickly, with taper thorns. Leaves lanceolate, entire, unarmed; smooth above; densely woolly and veiny beneath. Wool starry. Corymbs lateral.—Native of New South Wales, as well as of the tropical part of New Holland, in which last-mentioned country the prickles were observed by Mr. Brown to be more perfectly straight. This pretty species has not yet appeared in any garden. The stem is bushy, from three to five feet high, with round, downy, leafy, prickly branches, but every other part is unarmed. Leaves about three inches long, on woolly stalks; their upper side green, shining, quite smooth except the rib; under covered with dense white wool, composed of starry hairs, elevated on stalks. Flowers numerous, three-quarters of an inch broad, light blue, with orange anthers, each of whose terminal pores is closed by a separate lid. Berries scarlet, erect, the size of a currant, not longer than the lanceolate segments of their unarmed calyx.

S. Milleri. Miller's Nightshade. Jacq. Coll. v. 4. 209. Ic. Rar. t. 330. Willd. n. 81. Ait. Epit. 374. (*S. trilobatum, floribus parvis albis*; Linn. Sp. Pl. 270. *S. Schirnschuna*; Mill. Dict. ed. 8. n. 32.)—Stem shrubby, armed with hooked compressed prickles. Leaves sinuated or pinnatifid, obtuse, slightly prickly, smooth. Stalks mostly in pairs, single-flowered.—Native of the Cape
of

of Good Hope. Cultivated by Miller in 1762, but we know not whether it exists at present in any garden. The *branches* are irregular and spreading, bearing copious tawny prickles, shaped like those of a wild briar. *Leaves* stalked, an inch or inch and half long, green, sinuated like those of an oak. *Flowers* small, white, not unlike those of *S. nigrum*, but their *calyx* is thorny. *Berries* black, resembling the fruit of that species.

S. trilobatum. Three-lobed Nightshade. Linn. Sp. Pl. 270. Willd. n. 82. Ait. n. 38. Burm. Ind. 57. t. 22. f. 2. — Stem shrubby, armed with hooked compressed prickles. Leaves angular, somewhat three-lobed, obtuse, unarmed, smooth. Flowers racemose.—Native of the East Indies. Cultivated by Miller in 1759. A stove-plant, flowering in August. More slender than the last, with more distant, and less sinuated *leaves*, on longer *stalks*. But the much larger purple *flowers*, in double-branched lateral *clusters*, essentially distinguish the present plant, whose *branches* and *leaves*, the prickles excepted, might be thought to belong to some species of *Boerhavia*. Plukenet's t. 316. f. 5, is rather more like *S. Milleri*, but cannot be precisely determined, for want of the inflorescence.

Section 3. *Branches ending in thorns*. One species.

S. lycioides. Box-thorn Nightshade. Linn. Mant. 46. Willd. n. 83. Ait. n. 39. Jacq. Coll. v. 1. 96. Ic. Rar. t. 46.—Stem shrubby; branches with terminal thorns. Leaves elliptical. Flowers solitary.—Supposed to be a native of Peru. A stove-plant in England, flowering in May and June. Its habit is correctly compared by Linnæus to that of a *Lycium*. The *stem* is woody, with many long, trailing, slender, angular, smooth, leafy *branches*, finally becoming spinous at the extremity. *Leaves* stalked, about an inch long, smooth, entire. *Flowers* elegant, solitary, on lateral slender stalks, an inch in length. Segments of the *calyx* narrow, smooth. *Corolla* light-blue. *Anthers* short, orange. *Berry* scarlet, the size of a currant.

Notwithstanding our having here added twelve species to Willdenow's list, we are conscious that many still remain unsettled, of which we have only imperfect or uncertain specimens. The tropical regions of Africa probably possess several more. Besides those we have noticed, Mr. Brown defines fourteen new species in his *Prodromus* of the Flora of New Holland, under the following names. *S. tetrandrum*, *viride*, and *biflorum*, without prickles. *S. difcolor*, *violaceum*, *sulfuraceum*, *parvifolium*, *ellipticum*, *armatum*, *Hystrix*, *cinerum*, *pungetium*, *campanulatum*, and *echinatum*, with prickles on the stem, stalks, leaves or calyx. Among these the *Hystrix* is most remarkable for having prickles on the corolla itself.

SOLANUM, in *Gardening*, contains plants of the herbaceous, shrubby, and tuberous-rooted, esculent kinds, of which the species cultivated are: the love-apple, or tomato (*S. lycopersicum*); the Ethiopian nightshade (*S. æthiopicum*); the large-fruited nightshade, or egg-plant (*S. melongena*); the woody nightshade, or bitter-sweet (*S. dulcamara*); the mullein-leaved nightshade (*S. verbascifolium*); the shrubby nightshade, or winter cherry (*S. pseudocapsicum*); the oak-leaved nightshade (*S. quercifolium*); the dug-fruited nightshade (*S. mammosum*); the Indian nightshade (*S. indicum*); the Carolina nightshade (*S. carolinense*); the black-spined nightshade (*S. fodomeum*); the Palestine nightshade (*S. sanctum*); and the tuberous-rooted nightshade, or common potatoe (*S. tuberosum*).

In the first sort the fruit is smooth, but varies in form, size, and colour, from which Miller has formed two varieties; the first of which is commonly cultivated in the

south of Europe to put into soups and fauces, to which it imparts an agreeable acid flavour: the fruit is very large, compressed both at top and bottom, and deeply furrowed all over the sides, and of a red-yellow or yellowish colour. The latter is round, about the size of a large cherry, either yellow or red. It is a native of South America, flowering from July to September.

And in the third sort there are varieties with oblong violet-coloured fruit, with an oblong, white, large fruit, with a globular violet-coloured fruit, and with a globular white or variegated fruit. Some make other varieties, as red-fruited, yellow-fruited, prickly-fruited, &c.

Also in the fourth sort there are varieties with flesh-coloured, with white flowers, and with variegated leaves. Some have likewise gold striped-leaved, African thick-leaved, &c.

The sixth sort has also varieties with red and with yellowish fruit.

In the last sort, which is probably a native of Peru, or some part of that tract of continent, the principal varieties may be distinguished into two kinds, as the red-rooted and white-rooted sorts; the sub-varieties of which are extremely numerous; but for garden purposes, the following are the most useful kinds that are generally employed.

The early dwarf-red, the round-red, the oblong-red, the pale-red, the blood-red, the Irish red or painted lord, old winter-red, rough-red, and smooth-red.

Early forcing potatoe, the early dwarf-white, brown early, Cumberland early, early Scot, golden dun, early champion, white blossom, Manly white, kidney-white and red, red-nosed, true white, flat white, and superfine white early.

Many other kinds or varieties are made use of in gardens for raising the late as well as the early crops of this most useful root. In Lancashire, for the very early crops, they have principally recourse to the early kings, and foxes seedlings.

They also cultivate a small everlasting potatoe, as it is called, in the same situations, covering the beds with straw or some other material in the winter season, when necessary. A ready supply of the root may, it is said, be provided in this way by this sort of potatoe.

In the first volume of the Transactions of the Horticultural Society of London, sir Joseph Banks has given the following curious and interesting account of the introduction of this species of solanum, or the common potatoe, into this country and Europe. The notes from which this account has been principally taken, have, it is said, been some of them collected from authorities of difficult access by the learned and very intelligent Mr. Dryander.

It is stated, that the potatoe now in use was brought to England by the colonists sent out by sir Walter Raleigh, under the authority of his patent, granted by queen Elizabeth "for discovering and planting new countries, not possessed by Christians," which passed the great seal in 1584. Some of sir Walter's ships sailed in the same year, others, on board of one of which was Thomas Herriot, afterwards known as a mathematician, in 1585; the whole of them, however, returned, and probably brought with them the potatoe, on the 27th of July, 1586.

The said Thomas Herriot, who was probably sent out, as it is said, to examine the country, and report to those who employed him the nature and produce of the soil, wrote an account of them, which is printed in the first volume of De Bry's Collection of Voyages. In this account, under the article of roots, in p. 17, he describes a plant which is called Opanawk. "These roots are," he says, "round, some as large as a walnut, others much larger;

larger; they grow in damp soil, many hanging together, as if fixed on ropes: they are good food either boiled or roasted."

Gerarde in his *Herbal*, published in the year 1597, gives a figure of the potatoe, under the name of the potatoe of Virginia, and asserts, that he received the roots from Virginia, which are otherwise denominated Norembega.

The manuscript minutes of the Royal Society, 13th of December, 1693, assure us, that sir Robert Southwell, then president, informed the fellows, at a meeting, that his grandfather brought potatoes into Ireland, who first had them of sir Walter Raleigh.

This evidence, it is supposed by sir Joseph, proves, in no satisfactory manner, that the potatoe was first brought into England, either in the year 1586, or very soon after that period, and sent from thence to Ireland without delay, by sir Robert Southwell's ancestor, where it was cherished and cultivated for food before the good people of England knew its value; for Gerarde, who had this plant in his garden in 1597, recommends the roots to be eaten as a delicate dish, not as common food.

It appears, however, he says, that it first came into Europe at an earlier period, and by a different channel; for Clusius, who at that time resided at Vienna, first received the potatoe, in 1598, from the governor of Mons, in Hainault, who had procured it the year before from one of the attendants of the pope's legate, under the name of Taronoffi; and learned from him, that in Italy, where it was then in use, no one certainly knew whether it originally came from Spain, or from America.

Peter Cicca, in his *Chronicle*, which was printed in 1553, tells us, it is said, in chap. xl. p. 49, that the inhabitants of Quito, and its vicinity, have, besides mays, a tuberous root, which they eat, and call papas; this Clusius guesses to be the same sort of plant he received from Flanders, and this conjecture has, it is said, been confirmed by the accounts of travellers, who have since that period visited the country.

It is concluded that, from these details, it may fairly be inferred, that potatoes were brought into Europe from the mountainous parts of South America, in the neighbourhood of Quito; and that, as the Spaniards were the sole possessors of that country, there can be little doubt of their having been carried first into Spain, but that as it would take some time to introduce them into use in that country, and afterwards to make the Italians so well acquainted with them as to give them a name, there is every reason to believe, that they had been several years in Europe before they were sent to Clusius.

As the name of the root in South America is papas, and in Virginia that of opanawk; the name of potatoe was, it is said, evidently applied to it on account of its similarity in appearance to the battata, or sweet potatoe; and our potatoe appears to have been distinguished from that root, by the appellation of potatoe of Virginia, until the year 1640, if not longer.

It is added, that some authors have asserted, that potatoes were first discovered by sir Francis Drake in the South seas, and others, that they were introduced into England by sir John Hawkins; but in both instances, the plant alluded to is, it is said, clearly the sweet potatoe, which was used in England, as a delicacy, long before the introduction of our potatoes; it was imported, it is said, in considerable quantities, from Spain and the Canaries, and was supposed to possess the power of restoring decayed vigour. The kissing comfits of Falstaff, and other confections of similar imaginary qualities, with which our an-

celtors were duped, were, it is said, principally composed of these, and eringo roots.

It is also further noticed, that the potatoes themselves were sold by itinerant dealers, chiefly in the neighbourhood of the Royal Exchange, and purchased, at no inconsiderable cost, by those who had faith in their alleged properties. The allusions to this opinion are, it is observed, very frequent in the plays of that age.

Method of Culture.—These plants, from the great differences in their natures, habits of growth, and other qualities, must evidently require different modes of cultivation and management.

Culture in the Annual Kind.—The three first species, which are of this sort, may be raised from seed, which should be sown in the early spring on hot-beds, moulded over to the depth of six or seven inches with light rich mould, in drills or pots plunged into the beds. When the plants come up, they should be properly thinned, have a pretty free admission of air, and occasional waterings; and the love-apple kinds, when they have attained some growth, as five or six inches, and the weather becomes settled warm, should be removed into the open ground, planting them in a warm sheltered border, and placing them at a considerable distance. Some may be trained against a south fence, to have the advantage of the full sun: they should always be supported by some means or other to shew themselves, and ripen their fruit. But the egg-plants should be pricked out, when a few inches in height, into another hot-bed prepared for the purpose, at the distance of four or five inches; and some may be put in separate pots, and plunged in the bed, giving water and shade till they are fresh rooted; the waterings should be duly repeated, and fresh air freely admitted, when the weather is fine: it may also be requisite to remove them with balls about their roots to a third hot-bed, in order to have them very fine and strong: the frame should be raised as they advance in growth, and when the weather becomes fine and hot, they should be gradually hardened, and finally set out in the pots, &c. where they are wanted.

Culture in the Hardy Shrubby Kind.—The fourth sort, which is of this nature, may be increased by layers and cuttings, which may be laid down or planted out in the autumn or spring, where they will be well rooted by the following autumn, when they may be taken off and removed into nursery-rows, or where they are to grow for good.

Culture in the Shrubby Greenhouse Kind.—Likewise all the eight following sorts, which are of this description, may be increased by seeds, which should be sown thinly in rich light earth in the early spring in small pots, plunging them in the hot-bed under frames and glasses, watering them frequently, when the plants will soon come up, admitting fresh air daily; and when the plants are about two inches high, they should be pricked out upon another hot-bed, giving water and shade, till they are fresh rooted; and some may be put into pots, plunging them in the bed. As the warm weather advances, they should be gradually hardened to the open air, so as to be set out into it about the middle of the summer, when the weather is mild and fine.

And they should afterwards be managed as other shrubby exotic greenhouse plants.

There are also many of the tender shrubby hot-house or stove kinds, that are highly deserving of cultivation, such as the fiery-thorned American, Guinea, tomentose trilobate, and several other species.

These may all be increased by sowing the seeds of them, in the spring, in pots of light earth, to be plunged into a hot-bed;

hot-bed; when the plants are come up two or three inches in height, they should be pricked out separately into small pots, which are also to be plunged into the hot-bed or bark-bed of the stove, afterwards managing them as other shrubby exotics of the stove kind. The propagation and increase of them may likewise be tried, in some cases, by cuttings, which are to be set or planted in pots, and the whole plunged into the bark-bed, covering them close down by means of a hand-glass.

All these plants must be constantly kept in pots filled with light rich earth, and be retained, the most part of the year, in the stove, among collections of that sort, except for just a month or two in the height of the summer, when the heat is considerable. In this way they not unfrequently succeed very well.

These plants, in all the sorts, are very ornamental among other potted plants; and the first is cultivated likewise for the fruit as a pickle: the fourth is also ornamental in the borders, &c. of gardens and small pleasure-grounds.

Culture in the Potatoe Kind.—This last sort is highly valuable for its tuberosus esculent root, which is well known under the title of potatoe. These roots may be obtained for use plentifully almost the year round: the early sorts, being planted forward in the spring, often afford tolerable crops fit to take up in the beginning of June and in July following, especially in rich warm grounds; but the main crops are permitted to continue growing till autumn, as about the latter end of October or beginning of November, when the stalks or haulm begin to decay, at which time the roots will be arrived to full maturity: and being then taken out of the ground, and housed in some close dry apartment, keep in good perfection for eating all winter and spring, until the arrival of the new crops in the following summer.

With regard to the properties of the different sorts or varieties of this root, so far as they relate to their usefulness as food, or their nourishing qualities, there is probably no very material difference; but inasmuch as their agreeableness for the purpose of eating by man is concerned, there is considerable diversity, some sorts being naturally farinaceous and mealy, while other kinds are heavy and clayey, or waxy, the former of which are, for the most part, highly desirable and greatly relished, while the latter are disagreeable to and disrelished by many. The red sorts were formerly held in great esteem, and supposed the best; and though they are most probably in no respect inferior to those of the white kinds, these have of late, in general, been much preferred, especially the round, the oblong-white or whitish red, and the kidney sorts, as being more productive, more saleable in the markets, and the most desirable for eating.

This has caused the culture of the large red sort to be in a great degree overlooked and neglected, though some think that the potatoes of this kind are superior to those of the white sort in the richness of their flavour and some other qualities.

As both sorts, however, possess good qualities in different ways, the best and most useful varieties, in each kind, should be cultivated in sufficient and suitable proportions. The early sorts are, however, the most proper and suitable for being cultivated in gardens in most cases.

It is of importance in the garden, as well as the field, to have good-sized potatoes for sets, or for taking the sets from, whatever the sort may be, as the very small potatoes, or chats, as they are called, never answer well in this intention. And it is equally important to have a frequent change of the seed or sets which are employed for raising the crops, as every two or three years, new, or such potatoes as are fresh from other grounds, being found highly useful in pre-

venting degeneracy and promoting the goodness and abundance of the crops, as well as in obviating their tendency to the curl, which is so greatly injurious to them.

The potatoe is an annual plant, which leaves offsets, tubers, or roots, for its future propagation and increase.

All the varieties may be cultivated with success in any open situation. They delight in a moderately light rather dry soil and open situation, which should be rendered light with dung. The plants are increased by the root, either whole or cut in pieces, each cutting forming a proper set or plant. This is their general method of cultivation; but they may likewise be raised from seed to gain new varieties.

In most places the general season for planting this root is from about the middle or the latter end of February to the middle of April; the early sorts, for forward crops, being planted in the latter end of February or early in March; but for the general crops, March, and the first fortnight in April, is the most proper planting season, especially in moist land; as, if planted earlier, and much wet should succeed, it would rot the sets, more particularly if cuttings; though in cases of necessity, where the ground is not ready before, they may be planted any time in April, or even in May, and yield tolerable crops by October. And the ground for this purpose should always be dug over for the reception of the plants to one full spade deep.

But as to the planting, it may be performed by means of a dibble, by holeing in with a spade, or drilling in with a hoe, bedding in, &c. in rows at two feet asunder, eight, twelve, or fifteen inches distant in each row, and not more than four or five inches deep at the most.

Dibble-planting.—This is performed either with a common large garden dibble, blunted at the bottom, making holes four or five inches deep, at the distance before mentioned, dropping one set into each hole as you go on, and striking the earth in over them, or raking it afterwards, which is a better method.

The surface of the ground should, some time afterwards, be further raked, and left perfectly even and level.

Drill-planting.—In this mode the drills may be formed either with a large hoe, two feet asunder, and four or five inches deep, in which drop the sets a foot asunder, and cover them in with the earth equally the depth of the drill; or the drills may be made with a spade, and the sets covered in by means of a rake, the ground being left quite even on the surface.

Furrow-planting.—This is performed by the spade, by turning over or taking out a spit of earth all along, putting in the dung, and then dropping the sets in the furrow immediately upon it, and with the next spit turning the earth in upon the sets of the first; and in another furrow, two feet from this, putting in the dung and dropping another row of sets, which are covered in as above, and so on till the whole is finished.

Holeing-in planting.—This is performed with a spade. A man having a light handy spade, and beginning at one end of the line, takes out a spit of earth, forms a small aperture four or five inches deep, another person directly following after drops a set in the hole, the earth of the next spit immediately covers it up, and so on to the end of the work.

Trenching-in planting.—This is sometimes practised in light ground, and is effected as the person proceeds in digging or trenching the ground, being trenched in the common way, each trench two spades wide, and one spade deep, placing one row of potatoes in each trench: beginning at one end of the ground, opening a trench the proper width and depth, as above, then paring in the top of the next trench deeply, putting

putting it with some good dung in the bottom of the first, levelling it evenly, then digging along about half the width of the next or second trench, turning the earth into the first upon the dung, only two or three inches in depth, and upon which lay the potatoe-sets in a row along the middle eight or ten inches or a foot or more asunder; then digging along the rest or whole width of the said second trench a moderate spade deep, turning the earth of it into the first trench, over the sets, three or four inches deep; this done, dung the bottom of the open trench, and proceed with the digging and planting as before; and continue trench and trench to the end of the work.

Bedding-in planting.—This is sometimes done in low wet-tish land, for the sake of raising the beds, and sinking the alleys deep enough to drain off the too copious moisture, and is thus performed:—the ground is divided into four, five, or six-feet wide beds, with alleys two or three feet wide between bed and bed; and the beds being dug, the potatoe-sets are placed upon a little littery dung on the surface in rows lengthwise; and then the alleys dug out a spade deep, casting the earth over the sets about three or four inches thick; or the alleys may be first dug out to raise the beds, and the sets then planted with a dibble in the common method: thus, by either of these methods, in wet ground, the alleys being sunk, and the beds raised, the alleys drain off the redundant moisture, which might rot the sets before they begin to sprout out and grow.

And this method of planting is sometimes performed on grass or sward-land, marking out beds as above, with alleys between of proportionable width; then, without digging the beds, the potatoe-sets are placed immediately upon the sward at proper distances; the alleys being then dug and the spits turned grass-side downward upon the beds over the sets, covering them the proper depth as above, in which, if any additional depth is wanted, it may be supplied from the under earth of the alleys; and thus the sets being between two swards, grow, and often are productive of very good crops, if permitted to have full growth. This is a sort of lazy-bed mode of planting, that is not to be much practised in gardens.

In the after-management of the crops, where weeds begin to over-run the ground, two or three hoeings should be given to kill them and loosen the surface of the soil; and when the plants have some growth, some hoe up a ridge of earth close to each side of every row of plants in the first or second hoeing, to strengthen their growth more effectually, and render them more prolific, as the bottom of the stalks so landed up generally emits roots in the earth that become productive of potatoes the same as the principal roots.

In October, when the potatoes are full grown, they should in the general crops be wholly taken up before they are attacked by frost, and deposited in some dry apartment for keeping: some may however be taken up before for occasional use: this business is usually performed by a three-pronged fork, the ends of the prongs being a little blunted. The early crops are to be taken up as they are wanted for use, as seen below.

Before the potatoes are begun to be dug up, whether in the early or late crops, the haulm should be cut close to the ground and cleared away, in the former only to the extent of what is to be taken up at the time, but in the latter for the whole space which is to be dug up in the day, or other length of time, or for the quantity there may be. It is to be turned off in heaps on to the dug land, that the surface of the ground to be dug for potatoes may be rendered perfectly clear and convenient for the work. This is usually

done as the workman proceeds. In forking the crop up, the labour then goes on, by first opening a trench along one end of the ground to the depth and width of a good spit, proceeding in the same way with the rest, throwing the whole of the potatoes, as they are dug up, into large baskets placed for the purpose, carefully digging over all the land in a regular manner spit by spit, turning each clean upside down into the previous open trench. In this manner the whole is to be completed.

The early crops are best taken up as they are wanted, as they do not keep so good when dug up in large quantities.

The haulm is sometimes burnt, in the heaps as they lie upon the ground, but it is probably better to make use of it as litter, or to employ it for some garden purposes, which it may be made to answer.

When become perfectly dry and well freed from dirt and other matters, the potatoes may be put up and secured in the house, when for keeping, all the cut and bruised ones, as well as the chaps or very small ones, being previously sorted out and taken away. Towards the spring they may likewise be rubbed over to take off the sprouts and make them keep better.

When it is intended to raise new varieties from seed, some of the first flowering plants should be marked, the seed should be gathered in autumn when full ripe, and in the March or April following sown in some light soil, in an open situation, in shallow drills a foot asunder; and when the plants come up, they should be kept clear from weeds till autumn, when, about the end of October or beginning of November, the roots may be taken up, selecting the finest and largest, which preserve in sand till spring; then plant them in the common way, and by the autumn following they will have made proper increase, and attain full perfection; when their properties must be determined.

It is not improbable, from what has been written on the subject in the Transactions of the Horticultural Society of London, that much utility and advantage may be derived in the cultivation of the early or proper garden potatoe, from making use of new and more early varieties than such as have been usually employed. Formerly, the early varieties of this root were solely gained by accident from the seeds of the late sorts, and consequently not often produced; as the early sorts or varieties of this plant were well known to seldom or never afford either blossoms or seeds in the common methods of culture, they being only capable of being increased by portions of their tubers or roots. But by having recourse to such methods of management with them, as tend to prevent the preternaturally early forming of their tubers or roots, it has been found that seeds may be readily procured from the most early of the best early sorts, the seeds of which may, it is suggested, in successive crops, at last afford still more early and better varieties, than any which have hitherto been produced. This would be a great and important acquisition, especially in the garden culture of the potatoe. See POTATOE.

The manner of the cultivation of the potatoe in the preceding year, and the state which it is in from it, would seem also to have much influence on the produce of the succeeding year, as great benefit has, it is said, arisen from planting such potatoes as had grown late and not been fully matured in the preceding year. And in the early sorts it has been found, that the earliness likewise of the crops, to some extent, are dependent upon the state of the varieties; so that the success of the cultivator in raising an early crop of this kind, may be good or bad, according to the mode or manner of the culture, in the preceding year, of the tubers or plants. Such varieties as have the appearance of

being expended, worn out, and worthless, may also be restored, in some instances at least, to their original or primary vigour and importance by attention in this way.

Thus, by preparing proper tubers in the preceding year for planting out crops in the succeeding one, great utility may be produced in the garden cultivation of this root, as well as in the field.

In the same Transactions, in speaking of the preventing of the curl, the able president remarks, that the rough and uneven surface of the leaf in this plant, which, in excess, indicates, and indeed constitutes, the diseased state known by the above name, seems to exist in, and to form an essential characteristic, of every good variety of the potatoe; as he has never met with a single variety of the perfectly smooth polished-leaved kind that possessed any degree of excellence. And it is endeavoured to be proved, that this rough and crumpled state of the leaf probably originates in the preternaturally inspissated or thickened state of the fluid, in the firm and farinaceous potatoe. Such varieties, however, as have smooth and polished leaves, are, it is said, in general, the most productive, and grow in the most luxuriant manner, which, it is thought, partly shews, that the smooth leaf is a more perfect and efficient organ than the rough one; the latter indicating, it is supposed, some degree of approximation to disease.

It is stated, that by planting potatoe of an early variety in the same soil from which a crop of the same variety had been taken in the month of July, a second crop was produced. But the tubers produced by those last planted, were found to be much more soft and watery, when boiled, than others of the same variety, and consequently greatly inferior in value for all culinary purposes; they were on that account kept for future planting. It was inferred, on the principles that had been laid down, that the organizable matter these contained, being in a less firm and concrete state, it would prove more disposable, and that in the succeeding season, plants of stronger growth, and more smooth and perfect foliage, might consequently be expected. The result proved the inference to be every way true: the plants presented the appearance of a different variety, and afforded a more abundant crop and larger tubers than had ever before been obtained from the same variety. This trial was, it is said, confined to a single very early kind, which had previously produced partially curled leaves; but, it is supposed, the same method of management will prove equally advantageous with other varieties, which shew similar indications of incipient disease.

If this reasoning and mode of culture should turn out to be correct and well founded, they may be of great use in bettering and promoting the growth of this sort of valuable root.

By other writers this disease in the potatoe plant has, however, been supposed to arise in other ways, and to be of a very different kind; and it is stated, that Mr. Dickson, in the Transactions of the Caledonian Horticultural Society, conceives it to originate in debility, arising from the too great ripeness of the tubers, and in the parent plant having too much expended itself in affording blossoms and seeds, as well as tubers. In proof of which, the very curious fact is related, that a cutting taken from the extremity, which is most firm and farinaceous, of a long or kidney-shaped potatoe, will afford diseased plants, while another cutting taken from the opposite end of the same potatoe, will produce perfectly healthy plants.

But it is thought by Mr. Knight, that this opinion cannot be acceded to, as it is not to be supposed, that a plant which is a native of such a climate as the potatoe, can ever

be over-ripened in so northern a situation; besides, those varieties which never afforded either blossoms or seeds, have in his garden been quite as subject to the disease as others. Nor is it believed that the buds of the firm farinaceous extremity have greater maturity than those at the contrary end, as those nearest the parent plant are in reality the oldest, the tuber being formed by a branch, which has expanded itself in a lateral manner, instead of having extended itself in a longitudinal direction. Consequently the buds of it are arranged as they would have been upon the elongated branch; and every tuber, in its incipient state of formation, will extend itself into a branch, provided the plant, to which it belongs, be cut off close to the ground, and the current of ascending sap be in consequence diverted into, and through the tubers.

It is however found, by both the above inquirers, that a tuber, or part of one, which is soft and aqueous, affords a better plant than one which is firm and farinaceous, or in the mealy state.

It is said, in the corrected Agricultural Survey of Cornwall, that a gardener of Penzance, in that district, can ascertain when a potatoe chosen for a set will produce the curl; as a healthy potatoe will always, in his opinion, be largest, and rounded at its nose-end, while a diseased potatoe runs smaller at its nose-end than at the tail-end, and will produce the curl, if planted. It is noticed, that the form of the diseased potatoe here described is very easily distinguishable in the kidney sort, or in any long-shaped potatoe, but not so readily, or with such facility, in the round kind; yet it is supposed to be capable of being distinguished by attention, and a little practice, in all.

In regard to sets, as whole potatoes do not always answer well for the purpose, and as those of certain large sizes are better than small ones; the best mode of forming them is supposed to be that of taking off the sprout or nose-end, and the umbilical or tail-end of the potatoe, leaving the middle part entirely for the set. The worst mode of cutting the potatoe, in this intention, is, it is said, that of dividing it down the middle, from the nose to the tail, though a method much too commonly practised.

The preparing the sets beforehand, as in the preceding winter, from the fairest and best potatoes, and placing them in such dry situations, as that they may become inculted with their juice, and thereby bleed less before sprouting, than if fresh cut in the spring at the time of planting, is a practice adopted in Ireland with advantage. The set is, of course, stronger, and it puts forth a more vigorous shoot soon after being planted. The planting of small whole potatoes, or sets having more than two strong eyes or buds, is with reason commonly avoided; and those potatoes with a number of eyes, on what is termed the crown of the potatoe, are invariably rejected, with the small potatoes, both being found to produce languid shoots, and a number of small bad potatoes of no value. In all these states they are thought to be improper for planting as sets.

These hints, statements, and conclusions, may serve to extend and improve our knowledge of the nature of a disease which has long been so injurious to potatoe crops. See CURL.

SOLANUM Dulcamara, in the *Materia Medica*. See *Woody NIGHTSHADE*.

SOLANUM Nigrum. See *Garden NIGHTSHADE*.

SOLANUM Pomiferum, *Apple-bearing Nightshade*, in *Botany*, a name given by writers to the nightshades, and plants of several genera allied to those, and bearing large fruits. See *MELONGENA* and *LYCOPERSICON*.

SOLANUM Somniferum, *Sleepy Nightshade*, a name given by

by Caspar Bauhin, and some others, to a species of winter-cherry, the whorled alkekengi with small fruit.

SOLAR, something belonging to the sun.

Thus, we say *solar* fire in contradistinction to *culinary* fire.

SOLAR *Civil Month*. See MONTH.

SOLAR *Cycle*. See CYCLE.

SOLAR *Comet*. See DISCUS.

SOLAR *Eclipse*, is a privation of the light of the sun, by the interposition of the opaque body of the moon. See ECLIPSE.

SOLAR *Month, Rising, Spots*. See the substantives.

SOLAR *System*, the order and disposition of the several heavenly bodies, which revolve round the sun as the centre of their motion; *viz.* the planets, primary and secondary, and the comets. For a scheme of the solar system, see SYSTEM.

SOLAR *Year*. See YEAR.

SOLARI, ANDREA, in *Biography*, a native of Milan, called also del Gobbo. Vafari says he flourished in the time of Correggio; and praises him as a pleasing colourist, and a graceful designer. He is one of those artists whose figures of the Virgin, &c. are constantly sold as Lionardo da Vinci's productions. He died about 1530.

SOLAROSA, in *Geography*, a town of the island of Sardinia; 9 miles N.E. of Oristagni.

SOLARS, three small islands in the East Indian sea, subject to the Dutch, furnished with every kind of provisions: the middlemost is said to have a good harbour for shipping, situated to the E. of Ende island.

SOLATRUM, in *Botany*. See NIGHTSHADE.

SOLCI, in *Ancient Geography*, a port on the southern coast of the isle of Sardinia, between Cherfonnesus and Populum. Ptol.

SOLCK, in *Geography*, a town of the duchy of Stiria; 16 miles W.N.W. of Oberwoltz.

SOLDAN. See SULTAN.

SOLDANELLA, in *Botany*, from *solidus*, a piece of money, a name given to the Sea Bindweed, (see CONVULVULUS,) and to the plant of which we are about to speak, because of the thick orbicular form of their leaves. In like manner *Nummularia* was named, from *nummus*, in allusion to its round flat yellow flowers. (See LYSIMACHIA.)—Linn. Gen. 81. Schreb. 106. Willd. Sp. Pl. v. 1. 808. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 1. 310. Julf. 97. Tourn. t. 16. Lamarck Illustr. t. 99.—Class and order, *Pentandria Monogynia*. Nat. Ord. *Preciæ*, Linn. *Lysimachiz*, Julf. *Primulacæ*, Ventenat, Brown.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, in five deep, erect, lanceolate, permanent segments. *Cor.* of one petal, bell-shaped, gradually dilated upwards, divided into numerous, linear, straight segments. *Stam.* Filaments five, thread-shaped, very short; anthers simple, arrow-shaped, pointed, converging, shorter than the corolla. *Pist.* Germen superior, roundish; style thread-shaped, about the length of the corolla, permanent; stigma obtuse, notched, downy. *Peric.* Capsule nearly cylindrical, slightly curved, obliquely striated, of one cell, opening with five abrupt notched teeth at the summit. *Seeds* numerous, minute, pointed, attached to a central, columnar, unconnected *receptacle*.

Ess. Ch. Corolla bell-shaped, in many linear segments. Anthers beaked. Capsule cylindrical, of one cell, with several teeth at the summit.

1. *S. alpina*. Alpine Soldanella. Linn. Sp. Pl. 206. Willd. n. 1. Ait. n. 1. Curt. Mag. t. 49. Jacq. Austr. t. 13. Camer. Epit. 254. (*S. alpina*, major et minor; Clus. Hist. v. 1. 308, 309. Ger. Em. 838, 839.)—Na-

tive of the alps of Austria and Switzerland, and the Pyrenean mountains, flowering in spring. With us it is usually reckoned a hardy perennial, but succeeds best in a pot, sheltered in a frame in winter. Few, even of its alpine companions, are more singularly elegant. The root is fibrous. *Stem* none. *Leaves* several, stalked, spreading, round, smooth, convex, nearly or quite entire; somewhat heart-shaped at the base; paler underneath. *Flower-stalks* several, radical, erect, four or five inches high, smooth, each bearing one, two, or three drooping *flowers*, of a delicate purplish blue, occasionally white, with a red *calyx*, and two or three lanceolate *bractæas* at the base of the partial stalks. *Capsule* near an inch long. *Style* various in length.

SOLDANELLA, in *Gardening*, contains a plant of the low, herbaceous, perennial kind, of which the species cultivated is the alpine soldanella (*S. alpina*).

In this sort there is a variety which has all the parts smaller; the petiole is shorter and more slender, and the leaves are not so much rounded, but gradually widen from the petiole.

Method of Culture.—This is increased by parting the roots in autumn, about September, planting them in pots, or in a cool shady situation, where the soil is of a moist loamy kind, being frequently watered when the season is dry, and kept from the sun.

The seeds, soon after they become ripe, may also be sown in pots or boxes, filled with the above sort of mould, being placed in the shade, and frequently watered. The plants rise in the spring, and in the autumn following should be removed into separate pots, to have the protection of a frame in winter. They succeed best in a northern aspect.

These plants afford variety among other potted plants, in different situations about the house.

SOLDAU, or DZIADOREF, in *Geography*, a town of Prussia, in the province of Oberland; 100 miles S. of Konigsberg. N. lat. 53° 2'. E. long. 20° 4'.

SOLDER, SODDER, or Soder, formed from the French *soudure*, of the Latin *solidare*, to strengthen: is a metallic composition, used in foldering or joining together other metals.

For this purpose, it is required that folders melt sooner than the metal to be foldered, that they adhere firmly to its surface, and that they approach as near as may be to the metal foldered in hardness and colour.

The different folders are made of gold, silver, copper, tin, bismuth, and lead; usually observing, that in the composition there be some of the metal to be foldered mixed with some higher and finer metals.

The folder for gold is composed of fine gold, with one-fourth or one-half its weight of fine silver, accurately mixed together by fusion, and afterwards beat out into leaves, somewhat thinner than card-paper, and rendered as soft as possible by annealing. For the method of applying it, see SOLDERING.

Goldsmiths are said to make four kinds of folder; *viz.* folder of eight, where, to seven parts of silver, there is one of brass or copper; folder of six, where only a sixth part is copper; folder of four, and folder of three. It is the mixture of copper in the folder that makes raised plate always come cheaper than flat.

As mixtures of gold with a little copper are found to melt with less heat than pure gold itself, these mixtures serve as folders for gold; two pieces of fine gold are foldered by gold that has a small admixture of copper; and gold alloyed with copper is foldered by such as is alloyed with more copper: the workmen add a little silver as well as copper, and vary the proportions of the two to one another, so

as to make the colour of the folder correspond, as nearly as may be, to that of the piece. A mixture of gold and copper is also a folder for fine copper as well as for fine gold.

Gold being particularly disposed to unite with iron, this metal, with a high alloy of copper, proves an excellent folder for the finer kinds of steel instruments.

For larger works in iron and steel, copper, or an alloy composed of equal parts of tin and iron, is employed.

The folder used by plumbers is made of two pounds of lead to one of block-tin. Its goodness is tried by melting it, and pouring the bigness of a crown-piece on a table; for, if good, there will arise little, bright, shining stars in it.

For silver, two kinds of folder, *viz.* the hard and soft, are used and applied like the gold folder. The hard folder is composed of equal parts of silver and fine brass, and the soft is prepared by fusing the hard folder with $\frac{1}{3}$ th its weight of pure zinc. Another folder for silver may be formed of two parts of fine silver and one part of brass, taking care that these are not long kept in fusion, lest the brass fly off in fumes. For coarser silver, a folder is prepared by melting four parts of fine silver and three of brass, throwing in a little borax, and pouring it out as soon as it is melted.

The folder for copper is made like that of the plumbers; only with copper and tin; and for very nice works, instead of tin, they sometimes use a quantity of silver.

For copper, brass, and the hard alloys of copper, the best hard folder, says Aikin (*Dict.*), is composed of brass and zinc, in the proportion of from eight to sixteen of the former to one of the latter, according to the required hardness. The soft folder is composed of three parts of zinc and one of lead, and is applied by means of a common foldering iron, made red-hot.

Solder for tin is made of two-thirds of tin and one of lead, or of equal parts of each; but where the work is any thing delicate, as in organ-pipes, where the juncture is scarcely discernible, it is made of one part of bismuth, and three parts of pewter.

The pewterers use a kind of folder made with two parts of tin and one of bismuth: this composition melts with the least heat of any of the folders.

The folder for tin, pewter, and lead (or the plumber's folder), says Aikin (*ubi supra*), is of two kinds: the least fusible is composed of equal parts of tin and lead; the more fusible contains, besides, bismuth in various proportions. A very good soft folder is prepared by melting together sixteen parts of tin, eight of lead, and four of bismuth.

Spelter folder is made of one part of brass and two of spelter, and is used by the braziers and copper-smiths for foldering brass, copper, and iron. This folder is improved by adding to each ounce of it one pennyweight of silver. But as this folder does not melt without a considerable degree of heat, it cannot be used when it is inconvenient to heat the work red-hot; and therefore, in this case, copper and brass are foldered with silver.

Though spelter folder be much cheaper than silver folder, yet workmen in many cases prefer the latter. And Mr. Boyle informs us, that he has found it run with so moderate a heat, as not much to endanger the melting of the delicate parts of the work to be foldered; and if well made, this silver folder will lie even upon the ordinary kind itself; and so fill up those little cavities that may chance to be left in the first operation, which is not easily done without a folder more easily fusible than the first made use of. *Works Abridged*, vol. i. p. 135.

As to iron, it is sufficient that it be heated red-hot, and

the two extremities, in this state, be hammered together. By this means they become incorporated one with the other: when it is foldered it is usually done with brass; good tough brass, with borax applied, mixed with water to the consistence of paste.

The duke of Florence's nail, anciently so much admired, as being half iron and half gold, whereas those two metals were deemed irreconcilable, was joined by a kind of folder made by Turneisser, an ingenious chemist of Venice; the secret of which was never discovered till published by Tachenius. This folder is nothing but a little copper, or cyprus vitriol, put between the gold and the iron. For, naturally, the great acidity of the gold reduces the iron into a scoria or rust, when the two are applied over one another; but this inconvenience is removed, by the interposition of a little copper, be it in the smallest quantity imaginable. See the next article.

SOLDERING, or **SODDERING**, among *Mechanics*, the joining and fastening together of two pieces of the same metal, or of two different metals, by the fusion and application of some metallic composition on the extremities of the metals to be joined.

In foldering, some artifice is necessary to make the folder and metals adhere. All the metals, except silver and gold, upon melting, or before, are covered with dross: and all the folders have some of these metals in them: this dross hinders the folder and metal from uniting, and it is necessary to remove it. This is not performed in every kind of foldering by the same materials. The plumbers effect this by greasing the lead, laying on the folder, and melting it with a hot iron, and thus the dross, generated in fusion, unites with the grease, and flows away from the melted metal. The glaziers and tin-men use rosin in powder for the same purpose; for all inflammable substances that will melt are equally conducive to this use. When copper and brass are foldered with pewter, the work is first washed with a solution of sal ammoniac in water, then heated just hot enough to melt the pewter, and the pewter applied to the joint to be foldered. In foldering that requires a greater heat, borax is used.

Thus, in foldering gold, and also silver, take a piece of folder of the proper size and shape, and lay it on the part to be cemented, and sprinkle it over with pulverized borax; then apply the flame of a blow-pipe, which will cause both the borax and folder to fuse, the latter incorporating with, and adhering firmly to, the gold. When the juncture is complete, the piece is left to cool, and the borax is removed by boiling water, or, what is still better, a little dilute sulphuric or muriatic acid. It is observed, that the folder will, in this case, appear considerably paler than the other part, both on account of the silver with which it is alloyed, and of the borax, which always lowers the colour of the gold. This defect, however, may be remedied by melting on the surface of the folder a mixture of two parts of nitre and one of burnt alum, and afterwards washing it off with a soft brush and hot water; by which the natural colour of the gold will be restored, and even heightened. Others direct this operation to be performed by joining together the pieces proposed to be united with fine soft iron wire, and touching the joint to be foldered with a camel's hair pencil, dipped in borax finely powdered, and well moistened with water; and then placing a little folder upon the joint, and applying upon it a large piece of charcoal, and, with a blow-pipe and lamp, blowing upon it through the flame, until it melts the folder; and thus the work is finished. In order to cleanse silver or gold, after it is foldered, make it just red-hot, and let it cool; then boil it in alum-water, in

an earthen vessel, and it will be as clean as when new. If it be gold, boil it in urine and sal ammoniac.

For a method of foldering, particularly useful to optical and mathematical instrument-makers, see GRINDING of *Metallic Specula*.

SOLDIDO, a name given to the samoata.

SOLDIER, a military man, listed to serve a prince or state, in consideration of a certain daily pay.

The word is formed from the Italian, *foldato*, and that from the Latin, *solida*, or *solidata*, of *solidus*, the *solde* or *pay*; though Paquier chooses to derive it from the old Gaulish *foldoyer*, a foldier; and Nicod from *foldurius*.

The foldier is a person who takes pay; the vassal is one who is obliged to serve at his own expence: the volunteer serves at his own expence, and of his own accord.

Du-Cange observes, that the ancient soldiers were not to be short of five feet and a half; and that this measure was called *incoma* or *incommia*.

Every member of a society, capable of bearing arms, is obliged to serve and defend the state; and, therefore, should be disposed to take them up, at the first order of him who has the power of making war. In England this is the prerogative of the king, for to him belongs the right of granting commissions for raising troops; but he cannot compel any person to enlist, nor, without the concurrence of the parliament, keep an army on foot. In ancient times, especially in small states, every member, on a declaration of war, was a foldier: the whole community took up arms, and followed to the war. Soon after a choice was made, and armies formed of select men, whilst the rest of the people pursued their common occupations. At present the use of regular troops is almost every where adopted, especially in powerful states. The public authority raises foldiers, distributes them into different bodies, under the command of generals and other officers, and keeps them on foot as long as it thinks necessary. As every citizen or subject is obliged to serve the state, the sovereign has a right, in case of necessity, to enlist whom he pleases; but he should choose only such as are proper for the occupation of war: and it is highly proper to take, as far as possible, only volunteers, who enlist cheerfully without compulsion. See ENLISTING, IMPRESSING, and VOLUNTEERS.

No person is naturally exempt from taking up arms in defence of the state; the obligation of every member of the society being the same. Those only are excepted, who are incapable of handling arms, and supporting the fatigues of war. This is the reason why old men, children, and women, are excepted. Nevertheless, unless government is compelled by necessity, it should exempt from military service all who are employed in stations useful or necessary to society. Magistrates are, therefore, usually excepted; their whole time not being too much for the administration of justice, and the maintenance of order. The clergy, says Vattel, cannot naturally, and by any right, arrogate to themselves a particular exemption. To defend one's country is an action not unworthy of the most sacred hands. However, the reasons alleged in favour of magistrates may be urged also in behalf of that part of the clergy who are truly useful; such as teach religion, govern the church, and celebrate the public worship. But as for those immense multitudes of useless religious, who, under pretence of dedicating themselves to God, in effect spend their lives in an effeminate idleness, they have no right to claim a privilege that is pernicious to the state; and whilst the prince exempts them from military service, he injures the other members of the community, by throwing on them the whole burden. "I do not pretend," says Vattel, "to advise a prince to fill his

armies with monks, but gradually to diminish a useless class of men, by taking from it injurious and ill-grounded privileges." There is another class of idle persons, the exemption of whom is still more culpable; that useless class of footmen, who fill the houses of the great and wealthy: a class who by their calling corrupt themselves, by displaying the luxury of their master.

Among the Romans, while all the people served alternately in war, their service was gratuitous; but when a choice is made, and standing armies are formed, the state is to pay them; no man owing more than his quota of the public service; and if the ordinary revenues are not sufficient, it must be provided for by imposts. It is just that they who do not serve should pay their defenders. When the foldier is not in the field, there is a necessity of quartering him; and this burden naturally falls on housekeepers: but as it is attended with many inconveniences to the people, it becomes a good prince, or a wise and equitable government, to ease them of it as far as possible. Moreover, the asylums prepared for foldiers and reduced officers, who are grown old in the service, or whom fatigues or the enemy have rendered incapable of providing subsistence for themselves, may be considered as part of the military pay. The ease of these unfortunate victims of war is the indispensable duty of every state, in proportion to its ability. It is contrary, not only to humanity, but to the strictest justice, that generous citizens, heroes who have shed their blood for the safety of their country, should be left to perish with want, or unworthily forced to beg for subsistence.

Mercenary foldiers are foreigners voluntarily engaging to serve the state for money, or a stipulated pay. As they owe no service to a sovereign, whose subjects they are not, the prospect of advantage is their sole motive. It has been a question, however, whether the profession of a mercenary foldier be lawful, or not? or whether individuals may for money, or any other reward, engage to serve a foreign prince in his wars? This question, says Vattel, does not to me appear very difficult to be solved. They who enter into such engagements, without the express or tacit consent of their sovereigns, offend against their duty as subjects. But if their sovereign leaves them at liberty to follow their inclination for a military life, they are absolutely free. Now, every free man may join himself to whatever society he pleases, and which to him appears most advantageous. He may make its cause his own, and espouse its quarrels. He becomes in some measure, at least for a time, a member of the state in the service of which he engages: and as an officer is commonly at liberty to quit the service when he thinks proper, and the foldier at the term of his engagement; if, therefore, this state embark in a war, manifestly unjust, the foreigners may quit its service. And this mercenary foldier having now learnt the art of war, has rendered himself capable of serving his country, whenever it requires his assistance. The last consideration will furnish us with an answer to a question proposed on this head: whether the sovereign may, with equity and decency, permit his subjects to serve foreign powers indiscriminately for money? He may, because his subjects will by this means learn an art, the thorough knowledge of which is both useful and necessary. The tranquillity, the profound peace, which Switzerland has so long enjoyed, in the midst of all the commotions and wars which have agitated Europe; this long repose, it is said, would soon become fatal to it, did not the citizens, by serving foreign princes, qualify themselves for the operations of war, and support their martial spirit.

Mercenary foldiers engage themselves, and enlist voluntarily. The sovereign has no right to compel foreigners;

he is not even to make use of artifice or surprize, for inducing them to engage in a contract, which, like all others, should be founded on candour and probity.

As the right of levying soldiers belongs solely to the nation, so no person is to enlist soldiers in a foreign country, without the permission of the sovereign; and even with this permission, none but volunteers are to be enlisted: for the service of their country is out of the question here, and no sovereign has a right to give or sell his subjects to another. They who undertake to enlist soldiers in a foreign country, without the sovereign's permission; and, in general, whoever alienates the subjects of another, violates one of the most sacred rights both of the prince and the state. It is the crime distinguished by the name of *plagiat*, or man-stealing, and accordingly is punished with the utmost severity in every politic state.

All soldiers, natives or foreigners, are to take an oath to act faithfully, and not desert the service. This is no more than what they are already obliged to, the one as subjects, the other by their engagement; but their fidelity is of so great importance to the state, that too many precautions cannot be taken for rendering it secure. Deserters should be severely punished, and the sovereign, where he judges it necessary, may inflict capital punishment on them. The emissaries, who solicit them to desert, are far more guilty than the recruiters above mentioned.

Good order and subordination, so useful in all places, are no where so necessary as in an army. The sovereign should exactly specify and determine the functions, duties, and rights of military persons, as soldiers, officers, commanders of parties, and generals. He should regulate and fix the authority of commanders of all degrees, the punishments to be inflicted on offences, the form of trials, &c. The laws and orders relative to these several particulars form the military code.

These regulations, the particular end of which is to maintain order in the troops, and to render them capable of performing the best service, constitute what is called military discipline.

Judge Blackstone observes, that in a land of liberty it is extremely dangerous to make a distinct order of the profession of arms. In absolute monarchies this is necessary for the safety of the prince, and arises from the main principle of their constitution, which is that of governing by fear; but in free states, the profession of a soldier, taken singly and merely as a profession, is justly an object of jealousy. In these no man should take up arms but with a view to defend his country and its laws: he puts not off the citizen when he enters the camp; but it is because he is a citizen, and would wish to continue so, that he makes himself for a while a soldier. The laws, therefore, and constitution of these kingdoms, know no such state as that of a perpetual standing soldier, bred up to no other profession than that of war; and it was not till the reign of Henry VII. that the kings of England had so much as a guard about their persons.

The present regulations concerning the regular military force of our country, as contradistinguished from the militia, &c. and for regulating the royal marine forces when on shore, are chiefly contained in the yearly acts against mutiny and desertion. These comprehend the articles of war, enlisting of soldiers, including foreign soldiers, the number of whom allowed to be at one time in the united kingdom is extended by 46 Geo. III. c. 23. to 16,000, muster, the provision of carriages, billeting of soldiers, or quartering them by constables or other magistrates of cities, towns, villages, &c. in livery stables, ale-houses, victualling houses, the houses of sellers of wine by retail, and all houses

of persons selling brandy, strong waters, cyder, or methueglin, by retail; but in no private houses whatsoever; and the rates of subsistence to be paid to innkeepers, &c. for soldiers' quarters; the removal of soldiers in times of election of members of parliament; the mode of apprehending and punishing of deserters; maintenance and setting up trades after their discharge; the probate of their wills, &c. &c. Most of these particulars occur under their respective heads; and for others our limits require us to refer to the acts themselves.

As soldiers, by the annual act of mutiny, are put in a worse condition than any other subjects, so, by the humanity of our standing laws, they are in some cases put in a much better. By stat. 43 Eliz. cap. 3. a weekly allowance is to be raised in every county for the relief of soldiers that are sick, hurt, and maimed; and besides, the royal hospital at Chelsea is established for such as are worn out in their duty. Moreover, officers and soldiers, that have been in the king's service, are by several statutes, enacted at the close of several wars, at liberty to use any trade or occupation they are fit for in any town in the kingdom, (except the two universities,) notwithstanding any statute, custom, or charter to the contrary. And soldiers in actual military service, may make noncupative wills, and dispose of their goods, wages, and other personal chattels, without those forms, solemnities, and expences, which the law requires in other cases. Blackst. Comm. book i. cap. 13.

The profits attending the profession of a soldier, among the Romans, were very considerable. 1. Booty and plunder, with which they frequently returned home loaded, especially after taking any cities or towns; for these were generally given up to be plundered. 2. The subdued countries, which were often divided among the soldiers. 3. Their pay. 4. Clothes. 5. Provisions. 6. Farms and houses in provinces were also given them. 7. Many privileges and immunities, as that none could touch his goods in his absence in the camp. 8. Legacies, which the emperors left to be distributed among them. 9. Donatives. 10. Promotions to military honours lay open to every brave man, though of the meanest birth.

Not only humanity but interest require that great care should be taken of the health of soldiers. Much instruction may be drawn for this purpose from Dr. Pringle's excellent treatise, called "Observations on the Diseases of the Army." He there remarks, that the circumstances of soldiers in time of war differ from those of other people, in that they are more exposed to the injuries of the weather, and always crowded together, whether in camp, barracks, or hospitals: wherefore the most general division of these distempers may be into such as arise from the intemperature of the weather, and those from infection.

Military diseases depending on the weather, are reducible to two sorts, *viz.* to those of summer, and to those of winter. However, as expositions to cold are unavoidable upon the first encampment, as also for some time before the army usually goes into winter-quarters, the winter disorders, beginning about the end of autumn, will not entirely cease before the summer is well advanced; and, on the other hand, as the heats of summer and damps of autumn dispose the body to sickness, the camp-distempers are never quite over with the campaign, but continue some time after the troops retire into winter-quarters.

The summer diseases are all of a bilious or putrid nature, as those of winter are inflammatory. See FEVER, and the articles referred to under that subject.

SOLDIERS, *Exercise of.* See EXERCISE.

SOLDIERS, *Listing or Enlisting of.* See LISTING.

SOLDIERS,

SOLDIERS, Punishment of. See *Military EXECUTION.*

For other particulars relating to soldiers, see *DESERTER, Royal HOSPITAL, Camp HOSPITALS, COURT-Martial, MARTIAL Law, MUTINY, &c.*

SOLDIERS, Band of. See *BAND.*

SOLDIERS, Fresh-water, in Botany, a name given in several parts of England to the *fratiotes*, a distinct genus of plants, called by Boerhaave *aloides*.

SOLDIER-Wood. See *MIMOSA.*

SOLDIER'S Gut, in Geography, a cove on the north-east coast of the island of St. Christophers.

SOLDIN, a town of Brandenburg, the capital of a circle, and formerly the capital of the New Mark, situated on a lake of the same name, about six miles long, noted for its lampreys. The town contains about 200 houses, and two churches, and has some manufactures of cloth; 32 miles N. of Francfort on the Oder. N. lat. 53° 2'. E. long. 14° 59'.

SOLDO, in Commerce, a money of account and copper coin in Italy. Ferrara keeps accounts in lire of 20 soldi, or 240 denari correnti. The lira also contains 2 giuli or paoli; and the soldo, 6 quattrini. The feudo di Cambio is reckoned at 4 lire, or 80 soldi. At Florence, accounts are kept in feudo d'oro, ducati, or lire; each of these is divided into 20 soldi, or 240 denari, and distinguished by the names of soldi d'oro, soldi di ducato, soldi di lira; also in paoli of 13½ soldi di lira. Accounts of certain sales of goods are likewise kept in Pezze da otto reali, or livornine of 5¼ lire, which are likewise divided into 20 soldi, or 240 denari di Pezza. The copper coins at Florence are soldi, dueti or pieces of quattrini, single quattrini, and denari or piccioli. At Bologna, accounts are kept in lire of 20 soldi; the soldo, also called Bajocco or Bolognino, is divided into 12 denari, or 5 quattrini. At Rome, the feudo di stampa d'oro is divided into 20 soldi, or 240 denari. The coins at Bologna are of the same denomination, weight, and value, as those at Rome. The bolognini in silver is a single soldi; the copper soldi is its half, and quattrini the fifth part of a soldo. Kelly's Cambist.

SOLDURII, in Antiquity, a kind of military clients, or retainers to the great men in Gaul, particularly in Aquitania, mentioned by Cæsar.

The soldurii were people that shared all the good and ill fortune of their patrons; to whom, if any disaster happened, they either underwent the very same, or killed themselves; and Cæsar assures us, that no one had ever been known to refuse the alternative. Lib. iii. de Bell. Gall.

Vigenere takes them to have been more than common soldiers; and even gentlemen in pension, or appointment. Athenæus calls them *συναποθνησκοντες*, *q. d.* dying together, or with their masters.

SOLE, in Geography, a town of Norway; 6 miles S. of Stavanger.

SOLE, in Ship-Building, a sort of lining, to prevent wearing or tearing away the main part to which it may be attached; as to the rudder, bilgeways, &c.

SOLE is also a name sometimes given to the lower side of a gun-port, which, however, is more properly called the port-ill.

SOLE of a Horse, that plate of horn which, encompassing the fleshy sole, covers the whole bottom of the foot. The sole ought to be thick and strong, and the shoe of a horse so set upon the hoof as not to bear upon it, for otherwise the sole would be hurt, and not only make the horse lame, but destroy the flesh that separates it from the coffin-bone. It has been an absurd practice with some to take out the

sole. It is done without touching the outside of the hoof, as taking off the crust makes a *hoof-cast*. And a horse that has been unsoled, it is said, will recover in a few weeks. But this custom of *drawing* horses' soles, in order to relieve the inflammation of the part, and to promote a free perspiration, is not in the least beneficial, as it leaves such a weakness and tenderness behind, that the poor creatures mostly ever afterwards labour under an incurable lameness. And La Fosse, though he has recommended the practice, has not produced a single instance of its success. In lieu, therefore, of tearing the sole up by the roots, Mr. Wood advises the following method; in the first place, to take off from the tension of the vessels and lessen the inflammation, to draw away blood at the toe and above the hoof; after which, a poultice, composed as below, may be applied. This consists of linseed boiled in water to a pulp, then adding goose-grease, tar, and cow-dung to it; boiling them all together to the proper consistence.

The composition may be put to the foot, and all round the hoof; and a cold charge applied above the coronet. Where there is no great inflammation, the addition of a little soap to the poultice, may assist much in removing any coagulation of blood in that quarter.

When the foot is shaped like the back part of an oyster-shell, and the sole higher than the hoof, so that the whole foot is quite filled up on the lower part, it is called a *crowned sole*.

SOLE Corporation. See *CORPORATION.*

SOLEA, in Geography, a town of Italy, in the department of Panaro; 8 miles N. of Modena.

SOLEA, or Soli, a town of the island of Cyprus, formerly the see of a bishop, and in more ancient times called "Epea;" 30 miles N.N.E. of Bassa.

SOLEA, in Ichthyology, the *sole-fish*, a well-known fish, and much esteemed at table. See *SOAL*.

SOLEÆ, among the Romans, were a kind of sandals or slippers, which covered only the sole of the feet, and were bound on with thongs of leather; instead of which the women, and effeminate persons of the other sex, tied them on with purple-coloured ribbands, or such as were variously adorned with gold and silver.

SOLEBAY, in Geography. See *SOUTHWOLD*.

SOLEBURY, a township of Pennsylvania, in the county of Bucks, containing 1669 inhabitants; 30 miles N. of Philadelphia.

SOLECISM, SOLOECISMUS, in Grammar, a gross impropriety in speech, contrary to the use of language, and the rules of grammar, either in respect of declension, conjugation, or syntax. See *PURITY*.

The word is Greek, *σολοικισμός*, derived from the *Soli*, a people of Attica, who, being transplanted to Cilicia, lost the purity of their ancient tongue, and became ridiculous to the Athenians for their improprieties in it.

An actor on the Roman theatre having made a false gesture, the audience immediately cried out, he had committed a solecism with his hand.

Cicero, ad Herenn. lib. iv. cap. 12. distinguishes in the following manner between *barbarism* and *solecism*. "Latinitas est quæ sermonem purum conservat, ab omni vitio remotum. Vitia in sermone, quominus is latinus sit, duo pollutant esse; solecismus et barbarismus. Solecismus est, cum verbis plurimis consequens verbum superiori non accommodatur. Barbarismus est, cum verbum aliquod vitiose effertur."

Solecism is accounted by grammarians a much greater fault than barbarism, (see *PURITY*,) as it displays a greater ignorance

ignorance of the fundamental rules of the language. However, when solecisms are not very glaring, where they do not darken the sense, or suggest some ridiculous idea, the rhetorician regards them as much more excusable than barbarisms; because the former is accounted solely the effect of negligence, the latter of affectation. Negligence in expression, often the consequence of a noble ardour in regard to the sentiments, is, at the worst, a venial trespass; sometimes it is not even without energy; affectation is always a deadly sin against the laws of rhetoric. It ought also to be observed, that in the article of solecisms, much greater indulgence is given to the speaker than to the writer; and to the writer, who proposes to persuade or move, greater allowances are made, than to him who proposes barely to instruct or please. The more vehemence is required by the nature of the subject, the less correctness is exacted in the manner of treating it. Nay, a remarkable deficiency in this respect is not nearly so prejudicial to the scope of the orator, as a scrupulous accuracy, which bears in it the symptoms of study and art. Æschines is said to have remarked, that the orations of his rival and antagonist, Demosthenes, smelt of the lamp, thereby intimating that their style and composition were too elaborate. If this remark be just, it conveys the greatest censure that was ever passed on that eminent orator. But, as the intermediate degrees between the two extremes are innumerable, both doubtless ought to be avoided. Grammatical inaccuracies ought to be avoided by a writer, for two reasons; one is, that a reader will much sooner discover them than a hearer, however attentive he may be; the other is, as writing implies more leisure and greater coolness than is implied in speaking, defects of this kind, when discovered in the former, will be less excused than they would be in the latter. To enumerate all the kinds of solecism to which writers and speakers are subject, would be both an useless and endless task. The transgression of any of the rules of syntax is a solecism; and almost every rule may be transgressed in a variety of ways. Some of the more flagrant solecisms are those which betray an ignorance of the rudiments of the tongue; and others, which are more the effects of inattention, may be distinguished by the softer name of inaccuracies. For examples of both kinds we refer to Lowth, Priestley, Murray, and other grammarians. See also Campbell's *Philosophy of Rhetoric*, vol. i. b. 2. ch. 3.

SOLEDA, in *Geography*, a town of the island of Cuba; 56 miles S.S.E. of Havana.

SOLEFTA, a town of Sweden, in Angermanland; 40 miles N.N.W. of Hernösand.

SOLEIL. *Ombre de Soleil*. See OMBRE.

SOLEIL *de Mer*, in *Ichthyology*, a name given by the French writers, and by Rondeletius, to a peculiar species of star-fish, of a small size, the legs of which resemble very much the tails of lizards, and are very brittle.

Gesner describes also a species under the name of the sea-moon, *luna marina*, which, he says, is remarkably fragile, and which, from what else he has said of it in its description, appears also to be the same creature. The great character, however, of the creature's legs resembling, both in colour and figure, the end of the common brown land-newt's tail, is so expressive, that it cannot but be always known by it.

These rays are so extremely friable, that it is scarcely possible to touch them without their breaking, and they are not beset with points in the manner of the common rays of the creatures of this kind.

The other rays of star-fishes being furnished with many hundred legs, and these wanting them entirely, it follows,

that in this species the rays themselves must supply the place of legs, and assist the creature in walking; and thence its manner of walking must necessarily be different from that of any other kind. These rays are five in number, and are inserted very near the mouth of the creature, which is always placed in the centre of the star: the part where this aperture is situated, and which may be called the body of the animal, is of a roundish figure; the diameter of it is about a third part of the length of the rays; its under surface is flat, and its upper convex; and it is covered, both above and below, with scales, but they are arranged in different manners.

The common habitations of the sea-stars, on the rough shores of the sea, is no place for these tender creatures, every dash of a wave against a stone, if they were in the way, would break off their limbs; they have the caution, therefore, to fix their residence only in calm places, and where the shore is covered entirely with a deep smooth sand. When the water has forsaken them, they are often seen walking slowly on the shore; and in this case they use their rays as so many legs. As they divide the body of the fish into two equal parts, there is no ray before or behind any where, so that the creature goes with equal ease to any side that it likes. The best motion they are able to make is, however, very slow, and the ground on which they march ought to be very even; for if they attempt to hasten their pace, or if they find any thing uneven in their passage, one or more of their legs usually breaks; and this is the reason why this species is seldom found with its rays perfect. They never bury themselves deep in the sand, but just get under it, so as to be covered; and this they do by advancing two of the rays together, and burrowing carefully with them, and then following them with the rest of the rays and the body. *Mem. Acad. Par.* 1712.

SOLEISSEL, JAMES DE, in *Biography*, a celebrated master of horsemanship, was born in 1617, in the province of Forez. He was educated among the Jesuits, but followed, during his studies, a propensity which he had felt when very young, of attending to the manage, with which, when he arrived at man's estate, he joined the study of the diseases of horses. When he had made himself tolerably perfect in both branches of the science, he commenced teacher of horsemanship to the young noblesse of his province. The reputation which he soon acquired caused him to be invited to assist in the academy for the manage in Paris, where he published a work, entitled "Le Parfait Marechal," which became very popular, and was translated into several languages. He was likewise author of a treatise entitled "Le Marechal methodique," and of a Dictionary of the terms of horsemanship. He was a man of a very respectable private character, and possessed all the accomplishments that were necessary to his profession. He died in 1680.

SOLEK, in *Geography*, a town of Austrian Poland, in the palatinate of Sandomirs; 30 miles N. of Sandomirs.

SOLEMCO, a town of Hungary; 13 miles E.N.E. of Gros Wardein.

SOLEMN, SOLENNIS, something performed with much pomp, ceremony, and expence. Thus we say, solemn feasts, solemn funerals, solemn games, &c.

SOLEMN, in *Law*, signifies something authentic, or that is clothed in all its formalities.

SOLEMN *Acceptance*. See ACCEPTANCE.

SOLEMN *Testament*, in the *Civil Law*, is to be attested by seven persons, and sealed with their seals.

SOLEMN *Marriage*, is that performed in one's own parish-church, after publication of the banns, and in presence of witnesses.

SOLENS, or *Razor-Sheath*, in *Natural History*, a genus of the Vermes Testacea class and order, of which the generic character is as follows. The animal is an ascidia; its shield is bivalve, oblong and open at both ends; the hinge has a subulate reflected tooth; it is often double, and not inserted in the opposite valve. It had its name, *solen*, from the Greek, in which language that word expresses a pipe or tube; this fish, when the shells are closed, very aptly resembling a tube. The Latin writers have called it *unguis*, from its resemblance in colour and consistence to the human nail. The common people in many parts of France call it *couteiller*, and in Italy it is commonly called *cannolicchio*. (See SHELLS.) There are twenty-three species enumerated by Gmelin, which are as follow.

Species.

* **VAGINA**. The specific character of this is, that the shell is linear, straight, roundish, one end emarginated; the hinge is marked with a single opposite tooth in each valve. There is a variety that inhabits the European and Indian seas: it is six or seven inches broad, and only one inch long. The shell is yellowish, divided diagonally into two triangles, one of which is striate longitudinally, the other transversely, and marked with curved bands. This species, and all the others that are found in this genus belonging to this country, are figured by Barbut, Lister, Donovan, and other naturalists.

* **SILIQUA**. The shell of this species is linear, and straight; it has one hinge, which is two-toothed. There is a variety with rosy lunules. The former is found in most European seas, and on our own coasts. The latter is to be met with in the Indian seas. It is seven or eight inches broad, and not more than one and a half inch long. The shell is equally broad and compressed, with a double tooth at the hinge, receiving another opposite, and on one side there is another sharp tooth directed downwards: the colour is of an olive-brown, with a limpid ash-coloured mark dividing the shells diagonally: one part is striate longitudinally, the other transversely.

* **ENSIS**. Shell linear, a little bowed, like a scymitar: it has one hinge, which is two-toothed. It inhabits European seas. The shell is coloured, and marked like that of the siliqua; it is rounded at both ends; the two teeth of one valve are inserted into a triangular hollow of the other.

* **PELLUCIDUS**. Shell sub-arched, sub-oval, pellucid; one hinge two-toothed. This is found on the shores of Anglesea; the shell is thin and pellucid, about an inch broad, with a double sharp tooth in one valve, receiving a single one from the opposite, with a process in each shell pointing towards the cartilage of the hinge.

* **LEGUMEN**. Shell linear, oval, straight; hinges placed in the middle, and two-toothed; one of them bifid. It is found in the European and the Atlantic seas; is two inches and a half broad. The shell is sub-pellucid, radiate, from the hinge to the margin; it is rounded at both ends.

* **CULTELLUS**. The shell of this species is shaped something like a kidney, with a single tooth in one valve and two in the other. It inhabits European and Indian seas, and is more than two inches broad. The shell is fragile, covered with a rough cuticle, under which it is dirty-white, with tawny marks; both ends are rounded.

RADIATUS. Shell oval, straight and smooth, with a transverse depressed rib growing on one side. This is found in India, and is very thin and brittle. The shell is of a violet colour, with four transverse white rays, growing larger towards the thinner margin; the depressed rib run-

ning nearly the length of the shell; the hinge is callous on each side; both valves are two-toothed.

STRIGILATUS. Shell oval, obliquely striate. There is a variety which inhabits the Mediterranean, Atlantic, and Indian seas. The shell is rosy, with two white rays, strong and ventricose; the hinge is a little prominent at the margin, with a thin reflected tooth.

ANATINUS. The shell of this is ovate, membranaceous, and hairy, with a falcate rib at the hinge. It inhabits the Indian ocean, on a sandy bottom. The shell is pellucid, white, thin, like paper; one end rounded and closed, the other gaping, like the beak of a bird: there is a tooth in each valve resembling an ear-picker.

MACHA. Shell oval, oblong, truncate before; one hinge is two-toothed. It is found in the Pacific ocean. It is about six or seven inches long; in colour it is brown, varied with blue; it produces pearl.

BULLATUS. Shell roundish, inflated, sub-striate; the fore-part is gaping, in consequence of its crenatures. This is found in the American and Indian seas; brittle, white spotted or clouded with purple, longitudinally striate, sub-pellucid; hinge with a single tooth, marginal ones remote, compressed, and inserted in a hollow of the other valve.

MINUTUS. Shell oval, angles of the valves serrate. It is found in the northern parts of Europe, among zoophytes; is the size of a cucumber-seed; longitudinally striate, truncate at the top, with acute ferrate ridges, diverging from the hinge towards the top.

VIRENS. The shell of this is ovate-oblong, with tumid bosses. It inhabits Java; is very brittle, diaphanous, white, outwardly greenish, valves unequal, resembling in its shape the *Mya pictorum*; the tip and base hardly closed, with two approximate teeth in one hinge, and none in the opposite.

DIPHOS. Shell oval, straight, smooth, with prominent membranes. It inhabits the Indian ocean, and resembles the *S. radiatus*. It is two inches and a half long, and five broad; covered with a greenish cuticle, under which it is violet, with numerous rays; two of these are more distinct. The hinge has two teeth in one valve, and one in another.

MINIMUS. Shell linear-oval, straight; the hinges are lateral and two-toothed; one of them is bifid. It inhabits Tranquebar; resembles the *S. legumen*, but is much less; the cuticle is yellowish, under which it is clear white; the inner rib runs down the whole shell.

MAXIMUS. Shell linear, oval, straight, with arched striz; hinges lateral, two-toothed. It inhabits the shores of Nicobar; it is a very rare species. The shell is thin and pellucid, white, covered with a yellowish cuticle; it is four inches broad, one and a half long, gaping at both ends; the teeth of the hinge not receiving one another.

COARCTATUS. The shell of this is transversely wrinkled, contracted in the middle, rounded at both ends; hinge in the middle, with sometimes one, and sometimes two teeth in either valve. This is found on the shores of Nicobar, is about three-fourths of an inch long, and two and a half broad. The shell is of a dirty white, and gaping at both ends.

ROSEUS. Shell rosy, equivalve; the tooth of the hinge is rose-bifid, and inserted in a hollow of the opposite valve. It inhabits the Red sea, resembles the *Telina radiata*, but is open at both ends.

SANGUINOLENTUS. Shell oval, quite smooth; the hinge is callous, and two-toothed. It inhabits Jamaica; the beaks are rosy without and within.

STRIATUS. Shell equivalve, transversely striate; hinge with a single tooth. It is also found near the shores of

Nicobar, and is middle-sized. * The shell is thin, rosy, with white rays.

OCCIDENS. The shell of this species is transversely striate, smooth at the protuberant parts, radiate with white and reddish; both the hinges are two-toothed, with a hollow in the middle. Its residence is not known. The shell is marked with white and reddish spots scattered about; is more than four inches broad, and two long; both ends are gaping; the hinge is lateral.

* **CRISPUS.** The shell, in this species, is partly smooth, partly rough with undulate crimped lines; the hinge has a long narrow tooth. It is found in the river Tees, and resembles the *S. anatinus*, though it is thought by some naturalists not to be a distinct species.

SPENGLERI. Protuberances or beaks of the shell two-parted; primary tooth of the hinge rounded, accessory ones long and narrow; one of them is curved. The shell is hardly an inch long, but two and a half broad; it is rounded at both ends.

Rondeletius observes, that there are, among the solens of the same species, males and females, which are easily distinguishable from one another; and that the females are larger, have no variegations on the shells, and are much better tasted than the males. Rumphius has described a very remarkable species of solen, which always remains buried in sand, and which is not properly a bivalve, consisting only of one piece, though of the shape of the solen; he calls this *solen arenarius*. Litter has called the crooked species *solenes curvi*, and some call them the *scymitar* solens.

We have several species of the straight solens, though but few of the crooked ones.

Of the crooked solens, two are the only known species.

1. The *scymitar* solen. 2. The *solen arenarius*, always found in sand.

The shell of this fish is composed of two pieces, which are the two halves of a hollowed cylinder, with an elliptic base, divided in a longitudinal direction. These two pieces are fastened together near one end by a ligament, like that which joins the shells of the muscle or the oyster. From the place where this ligament is fixed, quite to the other end of the shell, there is a membrane fastened to each edge of the shell, and this increases in breadth in proportion to its distance from the place of its origin; so that, viewed externally, it forms a sort of isosceles triangle, the base of which was about two lines in breadth. The colour and consistence of this membrane give it very much the appearance of a piece of parchment; it has a considerable spring in it, and serves on occasion to open, or draw together, the two sides of the shell.

There is another membrane, of the same kind with this, fastened to the other side of the fish, there adhering to each shell, but this is of an equal breadth all the way down: this serves also to shut or open the edges of the shell. When the solen shuts its shell, it folds itself into several longitudinal wrinkles, which open again when the sides of the shells separate.

Hence it is to be observed, that though this shell has a power of opening and shutting, yet the body of the fish is always secured, and is no more exposed to sight at one time than at another, and there is no part where the fish can be seen but at the ends.

This fish lives in the sand on the sea-shore, where it buries itself often a foot and a half, or two feet deep; the length of the shell is, at this time, nearly in a vertical position, and the fish has a power of raising itself at pleasure up to the surface, and sinking down again, while the shell remains all the time buried in its place. Almost all

other animals have a horizontal motion, and the shell-fish of the sea crawl along upon its bottom under water, as the common land animals do on dry ground; but this creature's progressive motion is only vertical, and that confined to a very small compass; all that it is able to do for itself being only to raise itself higher or lower, and sink deeper or rise higher in the sand, within the narrow compass of about two feet at the utmost, as the going beyond that must occasion its destruction. Where these shell-fish are buried in the sand, there is a hole reaching from every one of them to the surface, by means of which they have a free communication with the water: these holes generally are placed in great numbers near one another, and are easily distinguished at a time when the tide has left the shore uncovered. They are not round, but oblong, and somewhat resemble the key-hole of a lock, but that they have a roundness at each end, whereas that usually is rounded only at one.

When it has occasion to ascend out of its hole, nothing more is required than the putting out the end of the leg, swelling it, and thus thrusting itself up to the length of that leg; then retracting it into the shell again, and thrusting out and inflating its end for a second movement of the same kind. These motions may be all perceived in the creature when out of the sand, particularly that by which it buries itself; for if held up in the fingers, it thrusts out the leg, and performs all the motions as if in the sand, making a fruitless attempt to save itself in its old way. Mem. Acad. Par. 1712.

Klein, and some others, have given the name solen to the several species of *tubuli marini*.

SOLENS, in *Geography*, a town of Westphalia; 6 miles S.S.W. of Magdeburg.

SOLENA, in *Botany*, so called by Willdenow, from *σωληνη*, a tube, or pipe, in allusion to the long tube of the flower. For the same reason, Schreber had named this same genus *Cyrtanthus*, but the latter appellation is now bestowed on a very different one. (See **CYRTANTHUS**.) Willd. Sp. Pl. v. 1. 961. (*Cyrtanthus*; Schreb. Gen. 122. Pofqueraia; Aubl. Guian. v. 1. 133. Juss. 201. Lamarck Illustr. t. 163.)—Class and order, *Pentandria Monogynia*. Nat. Ord. *Rubiaceae*, Juss.

Gen. Ch. Cal. Perianth superior, of one leaf, turbinate, in five acute, erect, permanent segments. Cor. of one petal; tube very long, cylindrical, recurved, dilated at the summit, its orifice fringed with hairs; limb in five deep, oblong, obtuse, reflexed segments. Stam. Filaments five, capillary, very short, incurved, somewhat unequal, inserted into the mouth of the tube, between the segments of the limb; anthers oblong, acute at each end, attached by their base. Pist. Germen inferior, elliptical; style capillary, as long as the tube; stigma minute, three-cleft. Peric. Berry elliptical, large, of one cell, full of pulp, and crowned with the calyx. Seeds about twelve, angular, imbedded in the pulp.

Ess. Ch. Calyx five-cleft, superior, permanent. Corolla salver-shaped, with a very long, incurved tube, hairy at the mouth. Stamens inserted into the rim of the tube. Style thread-shaped. Stigma three-cleft. Berry of one cell, with many angular seeds.

1. *S. longiflora*. Guiana Pipe-flower. Willd. n. 1. — (*Pofqueraia longiflora*; Aubl. Guian. v. 1. 134. t. 51.) — Found by Aublet, on the banks of the great rivers of Guiana, flowering in November, and bearing fruit in January. The Galibis call it *Aymara-pofqueri*, because a fish named *aymara* feeds on the berries. The stem is shrubby, five or six feet high, with a hard white wood, and slender, knotty,

knotty, smooth, opposite *branches*. *Leaves* opposite, stalked, elliptical, pointed, entire, veiny, smooth, about four inches long, each pair crossing the next. *Stipulas* in pairs between the footstalks, broad at the base, taper-pointed. *Flowers* about six, in a terminal *corymb*, white, drooping, slender, the tube of each about four inches long. *Fruit* yellow, succulent, sweet, and pleasant, the size of a guinea-hen's egg; the pulp red.

SOLENA is also the name of a genus, of the order of *Cucurbitaceæ*, in Loureiro's *Fl. Cochinch.* 514, which he thus denominates on account of the filaments forming a sort of sheath. The only species is *S. heterophylla*, a native of woods in China and Cochinchina, with which we are unacquainted, but which seems nearly related to *Bryonia*; only the *filaments* are monadelphous, and in the same flower with the *pistil*. The *berries* are scarlet. *Root* tuberous, of many white, oblong, farinaceous knobs, eatable, and, according to the author we follow, useful in consumptions and dysenteries, as well as the seeds.

SOLENANDRIA, so called by Ventenat, in his *Jardin de la Malmaison*, from *σάλω*, a tube, because of the union of the filaments. See GALAX.

SOLENHOFEN, in *Geography*, a town of Germany, in the principality of Anspach; 29 miles S. of Anspach.

SOLENIA, in *Botany*, a third generic name, (see SOLENA and SOLENANDRIA,) derived from *σάλω*, a tube, or pipe, is used in Hoffmann's *Flora Germanica*, v. 2. t. 8, for a minute genus of *Fungi*, whose tubular form it expresses. The species composing this supposed genus are, however, sunk in *Peziza*, by Perfoon in his *Synopsis Fungorum*, 675, of which they constitute the seventh section, being in all four species. See PEZIZA.

SOLENOE, in *Geography*, a town of Russia, in the government of Kolivan; 104 miles S. of Kolivan. N. lat. 52° 45'. E. long. 80° 54'.

SOLENOV, a lake of Russia, 60 miles long and 20 broad, with two islands, between lake Aral and the Caspian sea. N. lat. 43° 50' to 44° 50'. E. long. 56° 14'.

SOLES, in *Ancient Geography*, a town of Asia, in Cilicia, on the sea-coast, afterwards called Pompeiopolis.—Also, a town of the island of Cyprus, in which was a temple of Venus. See SOLOE.

SOLESMES, in *Geography*, a town of France, in the department of the North, and chief place of a canton, in the district of Cambrai; 9 miles E.N.E. of Cambrai. The town contains 3849, and the canton 16,419 inhabitants, on a territory of 140 kilometres, in 17 communes.—Also, a town of France, in the department of the Sarthe; 3 miles N. of Sable.

SOLE-TENANT, in *Law*, he or she who holds lands only in his or her own right, without any other person joined.

E. gr. If a man and his wife hold lands for their lives, the remainder to their son: here, the man dying, the lord shall not have heriot, because he dies not sole-tenant.

SOLEURE, in *Geography*, a canton of Switzerland, holding the eleventh rank in the Helvetic confederacy, stretches partly through the plain, and partly along the chains of the Jura, and contains about 50,000 souls, including the inhabitants of the capital. The soil is, for the most part, fertile in corn; and those districts which lie within the Jura abound in excellent pastures. The trade both of the town and canton is of little value, although the situation is commodious for an extensive commerce. It is divided into eleven districts or bailliages, called interior and exterior; the former are governed by bailiffs, who are senators, and remain in the towns; the latter by bailiffs selected

from the members of the great council, who reside in their bailliages. The inhabitants of the canton are Catholics, excepting those in the bailliage of Buckegberg, who profess the reformed religion. In spiritual offices, the Catholics depend on three bishops; but neither of these bishops can issue any ordinance, or even visit their dioceses, without the approbation of the senate. In this canton are two chapters; also an abbey of Benedictines, four convents, and three nunneries. Its principal charitable institutions are, an hospital at Soleure, and another at Olten, for the reception of burghers, subjects, and foreigners; the foundation of Thurigan, for old persons of both sexes belonging to the burghership; a founding hospital for orphans, and for children of poor burghers; and the hospital of St. Catharine, for the insane and incurables. In ecclesiastical affairs, the inhabitants of Buckegberg, who profess the reformed religion, though subject to Soleure, are under the protection of Bern: and though formerly this complication of political and religious interests created frequent misunderstandings between the two cantons, yet matters were amicably and finally adjusted on the 18th of November, 1618, at the treaty of Winingen. The inhabitants take the oath of fidelity, every third year, to the government of Soleure; but if aggrieved in their religious establishment, can have recourse to Bern. The senate of Bern nominates to the vacant benefices, but the priests are under the necessity of obtaining the confirmation of the chapter of Soleure. Bern also possesses supreme jurisdiction in criminal affairs. Soleure enjoys all the other rights of sovereignty; such as the power of levying taxes, appeals in the last resort, and the decision of all matrimonial and ecclesiastical concerns, with this proviso, that the decision shall be regulated according to the articles of the treaty of Winingen. With respect to the militia, all the males, from the age of 15 to 60, are formed into six regiments, consisting of about 8000 men, exclusive of 240 dragoons, and the corps of artillery, amounting to 600. The colonel of each regiment is always a senator, and the major a member, of the great council. The sovereign power resides in the great council, consisting of 102 members, chosen by the senate, in equal proportion, from the eleven tribes or companies into which the ancient burghers are distributed. The prerogatives of the great council are to enact and abrogate laws; to explain obscure parts of the constitution, and make alterations in the form of government; to levy taxes, declare war, and conclude peace; to contract alliances, receive appeals in criminal cases from the burghers of the capital, and in civil processes above the sum of two Swiss livres, or 6l. 3s.; to confer the new burghership, elect the treasurer, or fourth chief of the republic, from the ancient eleven senators, nominate to the seven exterior bailliages, &c. &c. To be qualified for admission into the great council, the candidate must be twenty years of age, an ancient burgher, and a member of the same tribe in which the vacancy happens. The great council assembles ordinarily once every month; and extraordinarily, when convened by the senate.

The senate, or little council, a constituent part of the great council, is composed of the two advocates or chiefs of the public, who annually alternate; the chancellor, or secretary of state, who has no vote; and 33 senators, drawn from the remaining 61 members of the great council, divided into 11 seniors and 22 juniors. The senate examines and digests all affairs, before they are submitted to the great council; is entrusted with the executive power, and care of the police; receives all appeals in the first instance from the inferior courts of justice; gives judgment in all civil processes, not exceeding

the value of 100 Swiss livres; and possesses supreme and final jurisdiction in criminal causes, except those in which a burgher of the capital is concerned, who may appeal to the great council. The senate also nominates, directly or indirectly, to most of the important charges of the republic; and confers the principal ecclesiastical benefices; it assembles regularly three times a week, and is convoked on extraordinary occasions by the reigning advoyer. A senator must be 24 years of age, a member of the great council, and drawn from the same company to which the last senator belonged.

Government draws its principal revenues, which do not exceed 12,500*l.* *per annum*, from the following sources: *viz.* a tax, called the tax for fortifications, laid on the funds of the tribes and monasteries in the town, and on those of parishes in the baillages; tythes and "rentes foncieres" belonging to the state; tolls; excise on wine; interest of money placed out in the canton and in foreign countries; monopoly of salt; revenues from the baillages; subsidy from France, about 1108*l.*; and sundry small sources, as demesnes, estates, salaries of vacant benefices, &c. The principal departments of government are the tribunals, comprising the inferior courts of justice, and the secret council of seven members; the boards of war; of rights, called "droits regaliens;" of finances, agriculture, and public buildings; of the police; and of ecclesiastical affairs, charitable institutions, and schools. The burghers are divided into ancient and new, the origin of the distinction being dated from 1681. About eighty-five families possess the right of burghership, and of these about thirty-four of the most illustrious supply the members of the great council, and fill the various departments of government. The burghers, both ancient and new, are distributed into eleven tribes or companies, each of which furnishes three senators and six members of the great council. The general assembly of ancient and new burghers, called "Rosengarten," or garden of roses, is held in the church of the Cordeliers on the day of St. John the Baptist, for the purpose of electing or confirming the charges of advoyer, banneret, and grand sautier; and the business of this meeting is conducted with great pomp and ceremony. From the manner of its proceeding, we may justly infer, that the government of Soleure is a most complete aristocracy. The government, however, is said to be mild and equitable; and the people are tranquil and contented. When Switzerland felt the effect of the French revolution, Soleure was one of the eighteen Swiss departments or cantons acceding to the division of 1798, and it formed one of the seventeen departments or cantons, acceding to the constitution of the 29th of May, 1801, and the number of its representatives was three. Soleure contains 288 square miles: its population, before the revolution, was 45,000; its contingent 600; and the era of its reception into the Helvetic confederacy A.D. 1481.

SOLEURE, the capital of the above-described canton, is pleasantly situated upon the Aar, which here expands its banks, and opens into a fine level river. This is a very ancient town; and though we reject the fabulous tradition of its having been built by the patriarch Abraham, it may be allowed that it was one of the twelve towns which were destroyed upon the emigration of the original inhabitants into Gaul. From a number of inscriptions, medals, and other ancient remains, found in its neighbourhood, it appears probable, that it was re-peopled by a Roman colony; and it was certainly a Roman station, as its ancient appellation, "Castrium Solodurense," implies. During the period of barbarism that succeeded the downfall of the Roman empire, it was

facked and destroyed by those northern nations which overran the greatest part of Europe. From the time of its re-establishment to that of its admission into the Helvetic confederacy in 1481, its state resembled that of many other imperial towns, which acquired a gradual accession of territory, and, after various struggles, finally secured independence.

Soleure is a small but very neat town, surrounded by regular stone fortifications, erected in the beginning of the last century; the walls enclose scarcely more than fifty square acres, and, including the suburbs, contain about 4000 souls. The new church, begun in 1762, and finished in 1772, is a noble edifice of whitish-grey stone, drawn from the neighbouring quarries, which is a species of marble, and admits a good polish. The lower part of the building is of the Corinthian, the upper of the Composite order; the façade, which consists of a portico, surrounded by an elegant tower, presents itself finely at the extremity of the principal street. Pizoni was the architect, and the expence amounted at least to 80,000*l.* Amongst the paintings in the interior, which is simple but elegant, the most esteemed is the Last Supper, by Corvi, a Roman artist. The town-house, though not worthy of any particular notice, is the place of meeting for the great council and senate. The public prison is a solid edifice of stone, well adapted to the purpose: the prisoners being confined in separate cells. The public library is of recent origin, and was formed by the Abbé Herman, canon of the cathedral; by whose assiduity and zeal it now contains more than 11,000 volumes. The circumjacent country is pleasing and diversified, and exhibits several points of view, which are as agreeable as wild, and as beautiful as romantic. N. lat. 47° 14'. E. long. 7° 19'. Coxe's Travels in Switzerland, vol. i.

SOLEURE, a town of France, in the department of the Forests; 4 miles N.E. of Longwy.

SOLEUS, in *Anatomy*, a muscle of the calf of the leg. See GASTROCNEMIUS.

SOLEUTINAN, in *Geography*, a small island in the lake of Nicaragua, near the south coast, with a town. N. lat. 11° 23'. W. long. 85° 36'.

SOLFACH, or SOLVA, a small sea-port town in the cwmwd of Mynyw, cantref of Pybidiog, (now called the hundred of Dewifland,) county of Pembroke, South Wales, is seated on the bank, and close to the mouth of the river Solfach, at the distance of 3¼ miles from the city of St. David's. "The estuary," says Mr. Fenton, "forms a curious inlet between two high hills, where a clear trout stream discharges itself, that has its source in Gwayn y Barry, and running by Lanrithan, receives a tributary stream near Llechmeylir, and so by Kerbyd and Carvoriog; then turning southward, after a course of six or seven miles, discharges itself here." The harbour at this place, forming part of St. Bride's bay, is safe and commodious; but the entrance to it is rendered dangerous by a large mass of rock in the mid of the channel. About 30 vessels of different descriptions belong to this port, from 20 to 250 tons.

Solfach may be said to be divided into an upper and lower town, both of which have progressively augmented in houses and inhabitants within the last four years. Historical Tour through Pembrokeshire, by Richard Fenton, esq. F.S.A. 4to. 1811.

SOL-FA-ING, in *Music*, the naming and pronouncing of the several notes of a song, by the syllables *sol, fa, la,* &c. in learning to sing it.

For a view of the origin of these syllables, see *Harmonical HAND*.

Though this system of solmification does not appear to have

have been wholly developed in the writings of Guido, to whom the invention of the gammut and harmonical hand has been commonly ascribed; yet Dr. Burney observes, that writers very near the period in which he lived give him the honour of its discovery; and particularly Sigebert, a monk of Gemblours, in the diocese of Namur, in Brabant, in his Chronicle under the year 1028. John Cotton also, who lived about a century after Guido, says that solmification by the six syllables, *ut, re, mi, fa, &c.* was practised by the English, French, and Germans; but the Italians, he adds, made use of other syllables; and by a passage from the Chronicle of Tours, under the year 1033, cited by Carpentier, in his Supplement to the Latin Glossary of Du-Cange, art. *Gamma*, Guido is put in full possession of the scale and solmification. About the end of the 17th century, the additional syllable *fi* was universally received in France for the seventh of the key of C. The earliest English writer, mentioned by Dr. Burney, who takes notice of the omission of *ut* and *re* in solmification, is Mr. Charles Butler, in his Principles of Music, published in 1636, and after his time the *ut* and *re* were rejected by all the English singing-masters; Dr. Holder, Dr. Wallis, and every writer on music in this kingdom, were unanimous in excommunicating these two syllables, till Dr. Pepusch endeavoured, and not unsuccessfully, to have them again restored.

An ingenious member of the Academy of Arcadia, in Rome, published a pamphlet in 1746, recommending a new method of solmification by twelve syllables, formed into twelve ideal words, *viz. utparè, bomisa, tufoldè, lanosì*, and comprehending the whole scale of semitones, from C to c exclusive. This method is approved by the celebrated composer Hasse, and by signor Giambattista Mancini, singing-master to the imperial family at Vienna. Signor Serra, in a treatise published at Rome in 1775, proposes to name the notes in singing by the seven first letters of the alphabet, distinguishing the flat, natural, and sharp notes by the addition of the three first vowels to the seven letters, as *ca*, *c* flat, *ce*, *c* natural, and *ci*, for *c* sharp, by which means the student is disembarrassed from all the mutations, and every found in the scale has a specific and invariable name appropriated to it. This method has been approved by several of the best masters in Rome.

Of the seven notes in the scale, *ut, re, mi, fa, sol, la, si*, only four are in use among us, *viz. fa, sol, la, mi*. Their office is principally in singing, that by applying them to every note in the scale, it may not only be pronounced more easily, but chiefly that, by them, the tones and semitones of the natural scale may be better marked out and distinguished.

The design is obtained by the four syllables, *fa, sol, la, mi*: thus, from *fa* to *sol* is a tone; as also from *sol* to *la*, and from *la* to *mi*, without distinguishing the greater or less tone; but from *la* to *fa*, also from *mi* to *fa*, is a semitone.

If then these be applied in this order, *fa, sol, la, fa, sol, la, mi, fa, &c.* they express the natural series from *c*; and if that be to be repeated to a second or third octave, we see by them how to express all the different orders of tones and semitones in the diatonic scale; and still above *mi* will stand *fa, sol, la*; and below it, the same reversed, *la, sol, fa*; and one *mi* is always distant from another by an octave; which cannot be said of any of the rest, because after *mi* ascending, comes always *fa, sol, la, fa, sol, la*, which are repeated invertedly, descending.

To conceive the use of this: it is to be remembered, that the first thing in teaching to sing, is to make one raise a scale of notes by tones and semitones to an octave, and descend again by the same notes, and then to rise and fall by greater

intervals, at a leap, as a third, fourth, fifth, &c. and to do all this by beginning at notes of different pitch. Then these notes are represented by lines and spaces, to which those syllables are applied; and the learner is taught to name each line and space by its respective syllable, which makes what we call *sol-fa-ing*; the use of which is, that while they are learning to tune the degrees and intervals of sound, expressed by notes set on lines and spaces, or learning a song to which no words are applied, they may do it the better by means of an articulate sound; but chiefly, that by knowing the degrees and intervals expressed by these syllables, they may more readily know the true distance of notes.

Mr. Malcolm observes, that the practice of *sol-fa-ing*, common as it is, is very useless and insignificant, either as to the understanding or practicing of music, yet exceedingly perplexing; the various applications of the several names, according to the various signatures of the clef, are enough to perplex any learner; there being no less than seventy-two different ways of applying the names, *sol, fa, &c.* to the lines and spaces of a particular system.

SOLFATARA, in *Geography*, a volcanic mountain, styled by the ancients the "Court of Vulcan," situated to the S. of the city of Naples. Its form is circular, and it is environed by hills of moderate elevation; and notwithstanding the vicinity of the fire, vines and fruit-trees grow very well on the outer declivity. The floor of the crater is white as chalk, composed of various materials, which, from the steam that rises, have been converted into a marly clay; or, perhaps, this was their original state, before they were acted upon by fire. Tiles placed over vent-holes, and serving as retorts, collect condensed alum, sal ammoniac, and sulphur: the air is very hot, and discolours paper and metals. Mr. Swinburne says, that the ground quaked and rebounded under his feet; and others conjecture that the hollow beneath is connected with mount Vesuvius: by laying his ear close to the ground, he could distinguish the bubbling and hissing of boiling water; and yet upon part of this crust or floor, chestnut-trees flourish in perfect vigour, and a variety of shrubs shoot up along the banks, where they find level ground into which to strike root, and are out of the blasting smoke. These hidden waters have their issue on the N. side of the mountain, where, in a dark valley, a fetid burning stream breaks out, and pursues its course among rocks and bushes, to the lake of Agnano. The Solfatara has not emitted flames within the memory of man, so that it is a kind of half extinct volcano; but wet weather increases the quantity of its smoke. Here are manufactures of sulphur, alum, and vitriol.

SOLFATARA, or *Lago di Bagni*, a lake of Italy, in the Campagna di Roma, containing several moveable islands of matted sedge and herbage, which may be pushed about by poles. The water is chalky and sulphureous; towards the surface hardly lukewarm, but at a greater depth, hot and continually boiling. Bathing in this water is recommended for cutaneous diseases: from the lake a river issues, which runs into the Tiber, 11 miles S.E. of Rome.

SOLFEGGIAMENTO, in the *Italian Music*, compositions, of which the syllables, *ut, or do, re, mi, fa, &c.* are the subject. See the next article.

SOLFEGGIARE, Ital. *Solfier*, Fr. is what the vulgar in England call *sol-fa-ing*. All these expressions imply the same thing,—naming the intervals in the first lessons of singing; for which, among regular bred musicians, the proper term in English is *solmification*; which see.

The *solfeggios*, or exercises for the voice, composed by Lco for the vocal students in the conservatories of Naples, were

were used, during the chief part of the last century, by all finging-masters unable to write to the wants and abilities of their scholars. But the passages in these, though excellent in their day, being now worn out and common, are generally superseded by the *solfeggii* of Aprile.

SOLFERINA, in *Geography*, a town of Italy, in the duchy of Mantua; 17 miles N.W. of Mantua.

SOLFWITZBURG, **SOLVESBORG**, or *Sylvisborg*, a seaport town of Sweden, in the province of Blekingen. This town, formerly more flourishing than it is at present, is almost furrounded by the Baltic sea. It has a harbour, and a castle in a ruined state. It is said to be the place where the Lombards assembled when they left their country, and migrated in search of new habitations; 35 miles W.S.W. of Carlscrona. N. lat. $56^{\circ} 9'$. E. long. $14^{\circ} 26'$.

SOLI, or *Asbaja Tuffa*, a town of Bosnia; 20 miles W.N.W. of Zwornick.

SOLI, or *Jokari Tuffa*, a town of Bosnia; 16 miles W.N.W. of Zwornick.

SOLIANOI, a fortrefs of Russia, in the government of Kolivan, on the Irtsch. N. lat. $54^{\circ} 20'$. E. long. $75^{\circ} 14'$.—Also, a town of Russia, in the government of Irkutsk; 20 miles N.N.W. of Selenginsk.

SOLIANSKOI STANITZ, a town of Russia, in the government of Irkutsk, on the Lena; 16 miles N.E. of Olekminsk.

SOLICITATION of Gravity. See **PARACENTRIC**.

SOLICITOR, or **SOLLICITOR**, *Solicitor*, a person employed to follow, and take care of, other persons' suits depending in courts of law or equity; formerly allowed only to nobility, whose menial servants they were; but now regularly admitted to practise in the court of chancery. See **ATTORNEY**.

The king has a solicitor-general, who holds his office by patent, during the king's pleasure. The attorney-general and he had anciently a right to their writs of summons, to sit in the lords house on special occasions, till the 13 Car. II. since which time, they have almost constantly been chosen members of the house of commons.

The solicitor-general has the care and concern of managing the king's affairs, and hath fees for pleading, besides other fees arising by patents, &c. He hath his attendance on the privy-council; and the attorney-general and he were anciently reckoned among the officers of the exchequer: they have audience, and come within the bar in all other courts.

To the queen's household there belongs also an officer with this appellation. See **PRECIDENCE**.

SOLID, in *Physics*, a body whose minute parts are connected together, so as not to give way or slip from each other, upon the smallest impression.

The word is used in this sense, in contradistinction to *fluid*.

SOLID Bodies, Atmosphere of. See **ATMOSPHERE**.

For the laws of gravitation of solids, immersed in fluids specifically, either lighter or heavier than the solids, see **GRAVITY and FLUID**.

To find the specific gravity of solids, and its ratio to that of fluids, see *Specific GRAVITY*.

For the laws of the resistance of solids moving in fluids, see **RESISTANCE**.

SOLID, in *Geometry*, is a magnitude endued with three dimensions, or extended in length, breadth, and depth. Hence, as all bodies have these three dimensions, and nothing but bodies, solid and body are frequently used indiscriminately.

A solid is terminated, or contained, under one or more

planes or surfaces, as a surface is under one or more lines. From the circumstances of the terminating lines, solids become divided into *regular* and *irregular*.

SOLIDS, Regular, are those terminated by regular and equal planes.

Under this class come the tetraëdron, hexaëdron or cube, octaëdron, dodecaëdron, and icoëdron. See **TETRAEDRON, CUBE, &c.**; and for the measure of these bodies, see **MENSURATION**.

SOLIDS, Irregular, are all such as do not come under the definition of regular ones. Such are the sphere, cylinder, cone, parallelogram, prism, pyramid, parallelepiped, &c.

For the ratio of geometrical solids, all prisms, parallelepipeds, cylinders, pyramids, and cones, are in a compound ratio of their bases and altitudes; so that if the bases be equal, they are in the simple ratio of the altitudes; or, if the altitudes be equal, they are as their bases: and as the bases of cylinders and cones are circles, and circles are in the duplicate ratio of their diameters, it follows that all cones and cylinders are in a ratio compounded of the direct ratio of their altitudes, and the duplicate ratio of their diameters.

The geneses, properties, ratios, constructions, dimensions, &c. of the several solids, regular and irregular, spherical, elliptical, conical, &c. see under each respective article. See also **MENSURATION**.

SOLID, Measure of a. See **MEASURE**.

SOLID, Cubature or Cubing of a. See **CUBATURE and SOLIDITY**.

SOLIDS, To find the Surfaces of. See **AREA, SUPERFICIES, and MENSURATION**.

SOLID of the least Resistance. See **RESISTANCE and ISOPERIMETRY**.

SOLID Angle, is that formed by three or more plain angles meeting in a point. (See **ANGLE**.) Or, more strictly, a solid angle, as B (*Plate XIV. Geometry, fig. 1.*), is the inclination of more than two lines, A B, B C, B F, which concur in the same point B, and are in the same planes.

Hence, for solid angles to be equal, it is necessary they be contained under an equal number of equal planes, disposed in the same manner.

And as solid angles are only distinguishable by the planes under which they are contained, and as planes thus equal are only distinguishable by comprence, they are similar; and consequently similar solid angles are equal, and *vice versa*.

The sum of all the plane angles constituting a solid angle, is always less than 360° ; otherwise they would constitute the plane of a circle, and not a solid.

The theory of solid angles is, perhaps, rather a subject of curiosity than utility; yet as it has given rise to much discussion amongst mathematicians, it may not be amiss to bestow a few lines in explanation of what we consider to be the most scientific method of considering this subject.

Euclid defines a solid angle to be that which is made by the meeting of more than two plane angles, which are not in the same plane, in one point; but a more general definition is, that "a solid angle is the angular space included between several plane surfaces, or one or more curve surfaces, meeting in the point which forms the summit of the angle."

According to this definition, solid angles bear just the same relation to the surfaces which comprise them, as plane angles do to the lines by which they are included; so that, as in the latter, it is not the magnitude of the lines, but their mutual inclination, which determines the angle; just so, in the former, it is not the magnitude of the planes, but their mutual inclinations which determines the angles. And

hence,

SOLID ANGLE.

hence, all those geometers, from the time of Euclid, who have confined their attention principally to the magnitude of the plane angles, instead of their relative positions, have never been able to develop the properties of this class of geometrical quantities; but have affirmed, that no solid angle can be said to be half or double of another; and have spoken of the bisection, trisection, &c. of solid angles, even in the simplest cases, as impossible problems. But all this supposed difficulty vanishes, and the doctrine of solid angles becomes simple and universal in its application, by assuming *spherical surfaces* for their measure, just as circular arcs are assumed for the measure of plane angles. This idea seems to have first occurred to Albert Girard, and published by him in his "Inventions Nouvelles en l'Algebra," an account of which is given at p. 7, vol. iii. Montucla's History of Mathematics. The principle of this method, however, seems to have escaped the attention of geometers, till it was recently brought forward again in vol. iii. of Hutton's Course of Mathematics, the writer of which, it should be observed, was not aware of the subject having been previously treated on the same principles by Girard. We shall, in what follows, avail ourselves of the latter article.

Imagine, then, that from the summit of a solid angle, (formed by the meeting of three planes,) as a centre, any sphere be described, and that those planes are produced till they cut the surface of the sphere; then will the surface of the spherical triangle, included between those planes, be a proper measure of the solid angle, made by the planes at their common point of meeting, for no change can be conceived in the relative position of those planes, without a corresponding and proportional mutation in the surface of the spherical triangle. If, in like manner, the three or more surfaces, which by their meeting constitute another solid angle, be produced till they cut the surface of the same, or an equal sphere, whose centre coincides with the summit of the angle; the surface of the spheric triangle, or polygon, included between the planes which determine the angle, will be a correct measure of that angle. And the ratio which subsists between the areas of the spheric triangles, polygons, or other surfaces thus formed, will be accurately the ratio that subsists between the solid angles, constituted by the meeting of the several planes or surfaces at the centre of the sphere.

Hence the comparison of solid angles becomes a matter of great ease and simplicity; for, since the areas of spherical triangles are measured by the excess of the sums of their angles, each above two right angles, and the areas of spherical polygons, of n sides, by the excess of the sum of their angles above $(2n - 4)$ right angles, it follows, that the magnitude of a trilateral solid angle will be measured by the excess of the sum of the three angles, made respectively by its bounding planes above two right angles; and the magnitude of solid angles, formed by n bounding planes, by the excess of the sum of the angles of inclination of the several planes above $(2n - 4)$ right angles.

As to solid angles, limited by curve surfaces, such as the angles at the vertex of cones; they will manifestly be measured by the spheric surface, in the same manner as angles determined by plane surfaces, are measured by the triangles or polygons they mark out upon the same, or an equal sphere. In all cases, the maximum limit of solid angles will be the plane towards which various planes determining such angles approach, as they diverge farther from each other about the same summit; the same as a right line is the maximum limit of plane angles, being formed by the two bounding-lines, when they make an angle of 180° . The maximum limit of solid angles is measured by the surface of the hemisphere, in

like manner as the maximum limit of plane angles is measured by the arc of a semicircle. The solid right angle (the angle, for example, of a cube) is $\frac{1}{4} = (\frac{1}{2})^2$ of the maximum solid angle; while the plane right angle is half the maximum plane angle.

The analogy between plane and solid angles being thus traced, we may proceed to exemplify this theory by a few instances; assuming 1000 as the numeral measure of the maximum solid angle = 4 times 90° solid = 360° solid.

1. The solid angles of right prisms are compared with great facility. For of the three angles made by the three planes, which by their meeting constitute every such solid angle, two are right angles, and the third is the same as the corresponding plane angle of the polygonal base; on which, therefore, the measure of the solid angle depends. Thus, with respect to the right prism with an equilateral triangular base, each solid angle is formed by planes, which respectively make angles of 90° , 90° , and 60° . Consequently, $90^\circ + 90^\circ + 60^\circ - 180^\circ = 60^\circ$, is the measure of such angle, compared with 360° , the maximum angle, and is therefore one-sixth of the maximum angle.

A right prism, with a square base, has, in like manner, each solid angle = $90^\circ + 90^\circ + 90^\circ - 180^\circ = 90^\circ$, which is one-fourth of the maximum angle; and thus it may be found that each solid angle of a right prism, with an equilateral

triangular base	=	$\frac{1}{6}$ max. angle	=	$\frac{1}{6}$	.1000
square base	=	$\frac{1}{4}$	=	$\frac{1}{4}$	.1000
pentagonal base	=	$\frac{1}{10}$	=	$\frac{1}{10}$	.1000
hexagonal	=	$\frac{1}{6}$	=	$\frac{1}{6}$	.1000
heptagonal	=	$\frac{1}{14}$	=	$\frac{1}{14}$	.1000
octagonal	=	$\frac{1}{8}$	=	$\frac{1}{8}$	.1000
nonagonal	=	$\frac{1}{18}$	=	$\frac{1}{18}$	.1000
decagonal	=	$\frac{1}{10}$	=	$\frac{1}{10}$	.1000
undecagonal	=	$\frac{1}{22}$	=	$\frac{1}{22}$	.1000
duodecagonal	=	$\frac{1}{12}$	=	$\frac{1}{12}$	.1000
m -gonal	=	$\frac{m-2}{2m}$	=	$\frac{m-2}{2m}$	.1000

Hence it may be shewn, that each solid angle of a regular prism with triangular base, is *half* each solid angle of a prism of an hexagonal base. Each with regular

square base	=	$\frac{2}{3}$ of each with regular octagonal base.
pentagonal	=	$\frac{3}{4}$ - - - decagonal.
hexagonal	=	$\frac{4}{5}$ - - - duodecagonal.
$\frac{1}{2}$ m -gonal	=	$\frac{m-4}{m-2}$ - - - m -gonal.

Hence, again, we may infer, that the sum of all the solid angles of any prism of triangular base, whether that base be regular or irregular, is half the sum of the solid angles of a prism of quadrangular base, regular or irregular; and the sum of the solid angles of any prism of

tetragonal base	=	$\frac{3}{4}$ sum of angles of pentagonal base.
pentagonal base	=	$\frac{4}{5}$ - - - hexagonal.
hexagonal base	=	$\frac{5}{6}$ - - - heptagonal.
m -gonal base	=	$\frac{m-2}{m-1}$ - - - $(m+1)$ -gonal.

2. Let us now compare the solid angles of the five regular bodies. In these bodies, if m be the number of sides of each face; n the number of planes which meet at each

solid angle; $\pi = \frac{1}{2}$ circumference, or 180° ; and A the plane angle made by two adjacent faces; then we have

$$\sin. \frac{1}{2} A = \frac{\text{cof. } \frac{\pi}{n}}{\text{fin. } \frac{\pi}{m}}$$

This theorem gives for the plane angle formed by every two contiguous faces of the tetraëdron, $70^\circ 31' 42''$; of the hexaëdron, 90° ; of the octaëdron, $109^\circ 28' 18''$; of the dodecaëdron, $116^\circ 33' 54''$; of the icosaëdron, $138^\circ 11' 23''$. But in these polyedra, the number of faces meeting about each solid angle are 3, 3, 4, 3, 5, respectively. Consequently the solid angles will be determined by the subjoined proportions.

$$360^\circ : 1000 :: \begin{cases} 3 (70^\circ 31' 42'') - 180^\circ : 87.736 \text{ tetraë.} \\ 3 (90^\circ) - 180^\circ : 250 \text{ hexaë.} \\ 4 (109^\circ 28' 18'') - 180^\circ : 216.351 \text{ octaë.} \\ 3 (116^\circ 33' 54'') - 180^\circ : 471.395 \text{ dodecaë.} \\ 5 (138^\circ 11' 23'') - 180^\circ : 419.301 \text{ icosaë.} \end{cases}$$

3. Solid angles at the vertices of cones, will be determined by means of the spheric segments cut off at the bases of those cones; that is, if right cones, instead of having plane bases, had bases formed of the segments of equal spheres, whose centres were the vertices of cones, the surface of those segments would be the measures of the solid angles at the respective vertices. Now the surface of spheric segments, is to the surface of the hemisphere, as the altitudes to the radius of the sphere; and, therefore, the solid angle at the vertices of right cones, will be to the maximum solid angle, as the excess of the slant side above the axis of the cone, to the slant side of the cone. Thus, if we wish to ascertain the solid angles at the vertices of the equilateral and right-angled cones; the axis of the former is $\frac{1}{2} \sqrt{3}$, and of the latter $\frac{1}{2} \sqrt{2}$, the slant side of each being unity. Hence,

$$1 : 1 - \frac{1}{2} \sqrt{3} :: 1000 : 133.97 \text{ angle at vertex equilateral cone.}$$

$$1 : 1 - \frac{1}{2} \sqrt{2} :: 1000 : 292.98 \text{ - - - right-angled.}$$

4. From what has been said, the mode of determining the solid angles at the vertices of pyramids will be sufficiently obvious. If the pyramids be regular ones, and N represent the number of faces meeting about the vertical angle in one, and A the angle of inclination of each two of its plane faces; also n the number of planes meeting about the vertex of another, and a the angle of inclination of each two of its faces; then will the vertical angle of the former, be to the vertical angle of the latter, as

$$NA - (N - 2) 180^\circ, \text{ to } na - (n - 2) 180^\circ.$$

If a cube be cut by diagonal planes into six equal pyramids, with square bases, their vertices all meeting in the centre of the circumscribing sphere; then each of the solid angles made by the four planes meeting at each vertex, will be $\frac{1}{3}$ d of the maximum solid angle; and each of the solid angles at the bases of the pyramids will be $\frac{1}{2}$ th of the maximum solid angle. Therefore, each solid angle at the base of such pyramid is $\frac{1}{3}$ th of the solid angle at its vertex, and if the angle at the vertex be bisected, either of the solid angles arising from the bisection will be double of either solid angle at the base; hence also each solid angle of a prism with equilateral triangular base, will be half each vertical angle of these pyramids, and double each solid angle at their base.

SOLID Figures, Like. See LIKE.

SOLID Bastion. See BASTION.

SOLID Place. See LOCUS.

SOLID Foot. See FOOT.

SOLID Numbers, are those which arise from the multiplication of a plain number, by any other whatsoever.

Thus, 18 is a solid number made of 6 (which is plain) multiplied by 3; or of 9 multiplied by 2.

SOLID Problem, in Mathematics, is one which cannot be geometrically solved, but by the intersection of a circle and a conic section; or by the intersection of two other conic sections besides the circle.

Thus, to describe an isosceles triangle on a given right line, whose angle at the base shall be triple to that at the vertex, is a solid problem, resolved by the intersection of a parabola and a circle.

SOLID Root, among Botanists, expresses the whole root to be one uniform lump of matter.

SOLID Square, in Military Language, a body of foot where both ranks and files are equal.

SOLID Theorem. See THEOREM.

SOLID Celery, in Gardening, that sort which is of a firm crisp nature, without any kind of opening or hollowness in the middle part of the stems. There is a sort of this kind, which has a very slight reddish tinge, that is greatly esteemed in some places. Solid celery commonly eats in a more crisp and agreeable manner than the hollow sort, and on that account is, for the most part, cultivated in the gardens of those who do not raise the plant for sale; but in the market-gardens, where sale is the great object, the common hollow kind is the sort that is the most in cultivation, as it grows much more quickly, and of course becomes sooner ready to be disposed of in the market, nor does the solid sort stand the frost so well in the winter. Celery being ready at an early period is a matter of very great importance and consideration in these situations, in consequence of the difference in price being often so great, as that which is early will not unfrequently fetch double the price, and more, of that which is late. See APIUM.

Neither this solid sort, nor the tall or giant celery, as it is called, are commonly thought so fit for winter crops. This solid kind was not known until long after the hollow sort had been in use, and the above variety is but lately known and cultivated.

SOLIDAGO, in Botany, from *solido*, to make firm, and, particularly, to heal a wound; an old name, synonymous with the English word Confound, and intended to express the reputed vulnerary powers of the plants which bore it.—Linn. Gen. 425. Schreb. 556. Willd. Sp. Pl. v. 3. 2053. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 5. 64. Sm. Fl. Brit. 889. Prodr. Fl. Græc. Sibth. v. 2. 179. Pursh 535. Juss. 181. Lamarck Illustr. t. 680. Gærtn. t. 170. (Virga aurea; Tourn. t. 275.) Class and order, *Syngenesis Polygamia-superflua*. Nat. Ord. *Composita discoidææ*, Linn. *Corymbifera*, Juss.

Gen. Ch. *Common Calyx* oblong, imbricated, with oblong, narrow, pointed, straight, converging scales. *Cor.* compound, radiated. Florets of the disk numerous, perfect, tubular, funnel-shaped, with a five-cleft spreading limb; those of the radius fewer than ten, usually five, ligulate, lanceolate, three-toothed, female. *Stam.* in the perfect florets, Filaments five, capillary, very short; anthers united into a cylindrical tube. *Pist.* in the same florets, Germen oblong; style thread-shaped, the length of the stamens; stigma cloven, spreading; in the female ones, Germen and style as in the former; stigmas two, revolute. *Peric.* none, the calyx remaining scarcely changed. *Seeds* solitary to each floret of the disk, obovate-oblong. Down capillary.

capillary. Those of the radius much the same. *Recept.* flattish, dotted, naked.

Eff. Ch. Receptacle dotted, naked. Down simple. Calyx imbricated, with converging scales. Florets of the radius about five.

The species of this genus, almost entirely American, vie with those of *Aster* in difficulty of determination. They are all perennial, mostly herbaceous, with simple undivided leaves, and paniced or spiked, almost always yellow, small flowers, and are known by the name of Golden Rods. Several are cultivated for ornament, more for curiosity. The *Hortus Kewensis*, enriched from Dr. Solander's manuscripts, has thrown great light on the present genus, as well as on *Aster*. Linnæus in *Sylt. Veg.* ed. 14, has only fourteen species of *Solidago*; Willdenow, profiting by Mr. Aiton's work, enumerates forty. Mr. Pursh reckons up fifty-one North American species alone. One only, subject to many varieties, is found in Britain.

So great a number of species now require to be added to Willdenow's catalogue, that it is necessary to take a compendious view of the whole, especially as we are furnished with more authentic specimens than most writers have had at their command.

Section 1. *Arborescent.*

1. *S. spuria*. Battard Tree Golden-rod. "Forst. *Comm. Gott.* v. 9. 68." Willd. n. 1. (*Conyza rugosa*; Ait. *Hort. Kew.* v. 5. 30.)—Stem arboreous. Panicle corymbose. Leaves oblong, wedge-shaped, serrated.—Native of St. Helena. Brought by sir Joseph Banks, in 1772, to Kew garden, where it flowers in the greenhouse in November. A spreading irregular small tree, with thick rugged branches, leafy at the ends. Leaves stalked, rugose, bright green, from a span to a foot long. Panicles large, level-topped. Flowers white, half an inch in diameter, with ten florets in the radius. *Forster.*

2. *S. Leucadendron*. White Tree Golden-rod. "Forst. *ibid.* 69." Willd. n. 2.—"Stem arboreous. Cymes level-topped. Leaves oblong-obovate, crenate, nearly sessile."—Native of woods in St. Helena. A tree, two or three fathoms in height. Branches dark brown, tuberculated, rather level-topped; leafy at the summit. Leaves smooth, spreading, three inches long, tapering at the base.—Flower-stalks cymose, smooth and slender. Flowers in every part like the preceding. *Forster.*

3. *S. arborescens*. New Zealand Tree Golden-rod. Forst. *Prodr.* 56. Willd. n. 3.—"Stem arboreous. Panicles corymbose, close, terminal. Leaves roundish-ovate, acute, wavy, stalked."—Native of New Zealand. Young branches downy. Leaves bluntly and distantly toothed; downy beneath. *Willd.*

Section 2. *Herbaceous.* Flowers unilateral. Leaves with three combined ribs.

4. *S. canadensis*. Canadian Golden-rod. Linn. *Sp. Pl.* 1233. Willd. n. 4. Ait. n. 1. Pursh n. 1. (*Virga aurea angulifolia*, panicula speciosa, canadensis; Pluk. *Almag.* 389. t. 236. f. 1.)—Stem downy. Leaves lanceolate, serrated, triple-ribbed, rough. Clusters copious, paniced, unilateral, recurved. Radius hardly exceeding the disk.—In hedges, old fields, and along fences, from Canada to Pennsylvania, flowering from July to September. From eighteen inches to five feet high. *Pursh.* The stem is angular, terminated by an ample downy panicle, of innumerable very small yellow flowers. Leaves sessile, three inches long, sometimes nearly entire, and occasionally downy. Pursh and, of course, Willdenow, copy the erroneous reference to Plukenet; a practice which overturns all confidence in the synonyms of authors who use it, as they cannot have judged of the description or figure cited.

5. *S. procera*. Great Golden-rod. Ait. n. 2. Willd. n. 5. Pursh n. 2.—"Stem villous, erect. Leaves lanceolate, serrated, triple-ribbed, rough; villous beneath. Clusters spiked, erect, drooping before flowering. Radius short."—In swamps, hedges, and about fences, from Canada to Virginia, flowering from July to September. From four to seven feet high. *Pursh.*

6. *S. serotina*. Upright Smooth Golden-rod. Ait. n. 3. Willd. n. 6. Pursh n. 3.—Stem erect, round, very smooth. Leaves linear-lanceolate, smooth, triple-ribbed, serrated, rough-edged. Clusters paniced, unilateral. Stalks downy.—In woods and hedges, from New England to Pennsylvania, flowering in September and October. Young leaves edged with copious little white rigid hairs.

7. *S. gigantea*. Gigantic Golden-rod. Ait. n. 4. Willd. n. 7. Pursh n. 4.—Stem erect, smooth. Leaves lanceolate, smooth, serrated, rough-edged, obscurely triple-ribbed. Clusters paniced, unilateral. Stalks hairy. Radius short.—In open low places, on the sides of fertile hills, from New England to Virginia, flowering from August to October. From four to seven feet high. *Pursh.*

8. *S. ciliaris*. Fringed Golden-rod. Willd. n. 8. Pursh n. 5.—Stem erect, smooth. Leaves lanceolate, somewhat triple-ribbed, smooth, rough-edged, slightly serrated. Clusters paniced, unilateral. Stalks smooth. Bractæas fringed. Radius short.—Sent from Pennsylvania, by the late Rev. Dr. Muhlenberg. The stem is angular. Radical leaves stalked, elliptical, pointed, veiny, serrated, rough, near a foot long. Branches of the panicle spreading. Bractæas minute. *Willd.*

9. *S. reflexa*. Hanging-leaved Golden-rod. Ait. n. 5. Willd. n. 9. Pursh n. 6.—Stem erect, villous. Leaves lanceolate, somewhat serrated, triple-ribbed, rough, reflexed. Clusters paniced, slightly unilateral.—In pine woods and old fields, from New Jersey to Carolina, flowering in August and September.

10. *S. lateriflora*. Lateral-flowered Golden-rod. Ait. n. 6. Willd. n. 10. Pursh n. 7. *Winn. Sp. Pl.* 1234? —Stem erect, rather hairy. Leaves lanceolate, obscurely triple-ribbed, smooth, rough-edged; the lower ones slightly serrated. Clusters paniced, unilateral, somewhat recurved.—In old fields and dry woods, from Canada to Carolina, flowering from August to October. The stem is from two to three feet high, striated, often purplish, furnished with numerous lateral flowering branches, as well as a principal terminal one. Leaves very smooth in the disk. Radius much longer than the calyx. This is probably the Linnæan plant, but some obscurity attends that question.

Section 3. *Clusters unilateral. Leaves veiny.*

11. *S. aspera*. Rough-leaved Golden-rod. Ait. n. 7. Willd. n. 11. Pursh n. 8. (*Virga aurea americana aspera*, foliis brevibus serratis; Dill. *Elth.* 411. t. 305.)—Stem erect, round, hairy. Leaves ovate, rather elliptical, very rough, rugged, serrated, without lateral ribs. Clusters paniced, unilateral.—In barren dry fields and woods, from New York to Carolina, flowering from September to November. *Pursh.* About a yard high. Leaves from one to two inches long, acute. Clusters dense, in some degree conical. Flowers small, yellow, the radius twice as long as the calyx.

12. *S. altissima*. Tall Variable Golden-rod. Linn. *Sp. Pl.* 1233. Willd. n. 12. Ait. n. 8. Pursh n. 9. (*Virga aurea altissima serotina*, panicula speciosa patula; Mart. *Cent.* 14. t. 14; and probably *V. aurea marilandica*, spicis florum racemosis, foliis integris scabris; *ibid.* 13. t. 13.)—Stem erect, hairy. Leaves lanceolate; the lower ones deeply serrated, very rough, rugose. Panicles unilateral.—

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In hedges and fields of North America, common, flowering from August to October. A very variable species, scarcely two individuals look alike. *Pursh*. The numerous paniced clusters spread horizontally, in a graceful manner, and all the flowers are turned upward. They are twice the size of *S. canadensis*, with a prominent radius, half as long again as the calyx.

13. *S. rugosa*. Wrinkle-leaved Golden-rod. Mill. Dict. ed. 8. n. 25. Willd. n. 13. Ait. n. 9. Pursh n. 10. (*Virga aurea novæ anglæ, rugosis foliis crenatis*; Dill. Elth. 416. t. 308.)—Stem erect, hairy. Leaves ovato-lanceolate; the lower ones closely ferrated, rugged, very rough. Clusters paniced, compound, widely spreading, unilateral.—In a dry barren soil, from Canada to Virginia, flowering from August to October. *Pursh*. The leaves are shorter and broader than in the foregoing. Flowers rather smaller.

14. *S. villosa*. Soft-leaved Golden-rod. Pursh n. 11. (*S. altissima* β ; Ait. ed. 1. v. 3. 212. ed. 2. n. 8. Willd. n. 12. *S. pilosa*; Mill. Dict. ed. 8. n. 9.)—"Stem erect, villous. Leaves lanceolate, rather soft, ferrated, without lateral ribs. Clusters paniced, unilateral."—In fields and woods of North America frequent, flowering from August to October. From eighteen inches to three feet high. *Pursh*.

15. *S. scabra*. Harsh-leaved Golden-rod. Willd. n. 14. Pursh n. 12.—"Stem erect, hairy. Leaves oblong, pointed; smooth above; rugged and rough beneath. Clusters unilateral."—In old fields and about fences, from Pennsylvania to Virginia, flowering from August to October. *Pursh*. Stem furrowed. Leaves tapering at each end, pointed, with equal, short, close-pressed ferratures about the middle.

16. *S. pyramidata*. Pyramidal Golden-rod. Pursh n. 13.—"Stem erect, round, hairy. Leaves oblong, acute, sessile, somewhat clasping the stem, smooth, rough-edged, sparingly and slightly toothed. Panicle naked, unilateral, pyramidal; its branches reflexed. Flower-stalks smooth."—Gathered by Mr. Enslin, in the "pine-barrens" of Georgia, flowering in August and September. About two feet high. The leaves decrease toward the beginning of the panicle, which consists of lively yellow very small flowers. *Pursh*.

17. *S. nemoralis*. Woolly-stalked Golden-rod. Ait. ed. 1. v. 3. 213. ed. 2. n. 10. Willd. n. 15. Pursh n. 14.—"Stem erect, downy. Stem-leaves lanceolate, hispid, entire; radical ones somewhat wedge-shaped, ferrated. Clusters paniced, unilateral."—In sandy and barren fields common, from Canada to Carolina, flowering from August to October. The whole plant has a grey aspect, and is about a foot, or sometimes two, high. *Pursh*.

18. *S. patula*. Short-spreading-branched Golden-rod. Willd. n. 16. Pursh n. 15.—Stem erect, smooth, angular. Leaves elliptical, ferrated, smooth; the radical ones oblong-spatulate. Clusters paniced, unilateral, spreading. Flower-stalks downy.—In shady woods, on a fertile soil, from New York to Virginia, flowering in September and October. Our specimen was sent by the discoverer of this species, the Rev. Dr. Muhlenberg, from Lancaster, Pennsylvania. Its stems are upright and wand-like, two feet high, angular and striated. Stem-leaves sessile, an inch long, pointed; the radical ones are said by Willdenow to resemble exactly those of *Chrysanthemum Leucanthemum*. The flowers are larger than most of the foregoing, but each cluster is hardly above an inch in length.

19. *S. ulmifolia*. Elm-leaved Golden-rod. Willd. n. 17. Pursh n. 16.—"Stem erect, striated, smooth. Leaves elliptical, pointed, deeply ferrated; villous beneath; radical ones obovate. Clusters paniced, unilateral. Flower-stalks

villous. Rays short."—In swamps and shady woods, from New York to Virginia, flowering from August to October. *Pursh*. Radical leaves almost the same as the last, but more deeply ferrated, covered with hairs on both sides; the rest elliptical or ovate-oblong; smooth above; villous about the veins beneath. Flower-stalks villous; the partial ones clothed with scattered hairs, and accompanied by bractæas.

20. *S. arguta*. Sharp-notched Golden-rod. Ait. ed. 1. v. 3. 213. ed. 2. n. 11. Willd. n. 18. Pursh n. 17.—"Stem erect, smooth. Leaves smooth, sharply and unequally ferrated; those of the stem elliptical; radical ones ovate-oblong. Clusters paniced, unilateral. Rays elongated."—In woods and meadows, from Canada to Virginia, flowering from September to November. *Pursh*.

21. *S. juncea*. Rushy-stalked Golden-rod. Ait. ed. 1. v. 3. 213. ed. 2. n. 12. Willd. n. 19. Pursh n. 18.—Stem erect, smooth. Leaves lanceolate, smooth, rough-edged; the lower ones ferrated. Clusters paniced, unilateral.—In sandy fields and woods, from New Jersey to Carolina, flowering from August to October. The stem is brownish, somewhat angular and striated, leafy, copiously paniced at the top, with spreading, recurved, dense, oblong, compound clusters, a finger's length or more, whose partial stalks are roughish, bearing many small, lanceolate, obtuse bractæas. Florets of the radius twice as long as the calyx.

22. *S. elliptica*. Oval-leaved Golden-rod. Ait. ed. 1. v. 3. 214. ed. 2. n. 13. Willd. n. 20. Pursh n. 19. (*S. latissimifolia*; Mill. Dict. ed. 8. n. 14. *Virga aurea canadensis, latissimo folio glabro*; Tourn. Inf. 485.)—Stem erect, smooth. Leaves elliptical, smooth, ferrated. Clusters paniced, unilateral. Rays of a middling length.—In shady woods among rocks, from New York to Virginia, flowering from August to October. *Pursh*.

23. *S. dubia*. Lanceolate-leaved Golden-rod. Scopoli Del. Infubr. v. 2. 19. t. 10.—Stem erect, striated, slightly hairy. Leaves lanceolate, smooth, distantly toothed. Clusters paniced, unilateral, rather hairy; the lower ones axillary. Bractæas lanceolate, smooth.—Cultivated in the botanic garden of Pavia, from whence we obtained a specimen in June, 1787. The plant was supposed by professor Scopoli to be a native of North America, but we cannot refer it to any described species. The late Mr. Dryander, at that time intent on preparing the *Hortus Kewensis* for the press, considered our specimen as coming nearest to *S. elliptica*, but its leaves are narrower, and bractæas much less. Most of the clusters are axillary, composing a leafy panicle, and about as long as their corresponding leaves. Florets of the radius rather numerous. The foliage is rigid, entirely smooth, finely toothed, not ferrated, somewhat triple-ribbed; indeed more so than in *lateriflora*, n. 10, next to which species, in the first section, we should have placed the present, but for its alleged affinity to *elliptica*.

24. *S. asperata*. File-leaved Golden-rod. "Bankf. MSS." Pursh n. 20.—"Stem paniced, corymbose. Clusters nearly erect. Flowers ascending. Leaves lanceolate, ferrated, rough."—In Canada, according to the Bankfian herbarium. *Pursh*.

25. *S. recurvata*. Recurved Golden-rod. Willd. Enum. 889. Pursh n. 21.—Stem erect, downy. Leaves lanceolate, ferrated, rough-edged. Clusters elongated, unilateral, recurved, paniced. In shady woods, from Pennsylvania to Virginia, flowering from September to November. *Pursh*. Leaves lanceolate, pointed, deeply ferrated, nearly smooth, except at the edges. Willdenow.

26. *S. sempervirens*. Narrow-leaved Evergreen Golden-rod. Linn. Sp. Pl. 1232. Willd. n. 21. Ait. n. 14. Pursh

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Pursh n. 22. (*S. maxima americana*; Cornut. Canad. 168. t. 169. *Virga aurea*, five *Solidago procerior americana*, caule multiplici; Pluk. Phyt. t. 235. f. 5.)—Stem erect, smooth. Leaves linear-lanceolate, rather fleshy, smooth, entire, rough-edged. Clusters panicled, unilateral. Flower-stalks roughish.—In swamps, and on the banks of rivers, from Canada to Pennsylvania, flowering from September to November. *Pursh*. A tall, smooth, purplish and somewhat glaucous species, with copious, long, narrow leaves, and dense oblong panicles, of unilateral clusters. Radiant florets long, narrow, rather numerous.

27. *S. virgata*. Slender Wand-like Golden-rod. Michaux Boreal-Amer. v. 2. 117. Pursh n. 23.—“Stem smooth, quite simple. Leaves lanceolate, somewhat wedge-shaped, obtuse, entire, very smooth, close-pressed; the upper ones gradually smaller. Branches of the panicle elongated, with terminal clusters. Flower-stalks smooth, unilateral.”—In shady wet woods of Lower Carolina and Georgia, flowering from August to October. About two feet high, extremely smooth and slender. *Pursh*.

28. *S. odora*. Sweet-scented Golden-rod. Ait. ed. 1. v. 3. 214. ed. 2. n. 15. Willd. n. 22. Pursh n. 24. (*Virga aurea americana*, tarraconis facie et sapore, paniculâ speciosissimâ; Pluk. Phyt. t. 116. f. 6.)—Stem erect, downy, striated. Leaves linear-lanceolate, entire, smooth, rough-edged. Clusters panicled, unilateral, nearly simple.—In dry sunny situations, on fertile woodlands, from Canada to Carolina, principally throughout the Allegany mountains, flowering from August to October. This is most generally and principally known among the inhabitants by the name of Golden-rod, and used as a wholesome tea. The flowers, gathered when fully expanded, and carefully dried, afford a most agreeable substitute for tea, which for some time has been an article of exportation to China, where it fetches a high price. *Pursh*. The upper part of the stem is regularly furrowed. Clusters two or three inches long, spreading horizontally, each mostly accompanied by a leaf; their stalks angular and rough. Bractæas oblong, smooth.

29. *S. retrorsa*. Reflexed Golden-rod. Michaux Boreal-Amer. v. 2. 117. Pursh n. 25.—“Stem erect, round, rough. Leaves closely sessile, reflexed, linear-lanceolate, pointed, rough-edged; somewhat keeled beneath. Clusters of the panicle recurved.”—In open swamps of Virginia and Carolina, flowering in August and September. *Pursh*. Said by Michaux to be akin to the last. We have had no opportunity of comparing them.

Section 3. Clusters erect.

30. *S. pauciflorescens*. Starved-flowered Golden-rod. Michaux Boreal-Amer. v. 2. 116. Pursh n. 26.—“Smooth, somewhat shrubby. Leaves lanceolate, obtuse, without ribs. Panicle compound, many-flowered; tufts of flowers erect. Calyx narrow-oblong, with five florets in the disk, and one in the radius.”—In the “sand-barrens” of Virginia and Carolina, flowering from August to October. *Pursh*.

31. *S. bicolor*. Two-coloured Golden-rod. Linn. Mant. 114. Willd. n. 23. Ait. n. 16. Pursh n. 27. (*Virga aurea*, flore albo spicato; Pluk. Phyt. t. 114. f. 8, not 3, as Willdenow and Pursh have it.)—Stem hairy. Leaves elliptical, hairy; the lower ones serrated; those on the flower-branches entire, numerous, and small. Clusters erect. Scales of the calyx obtuse.—In woods and on dry hills, from Canada to Carolina, flowering from August to October. Distinguished by its short close clusters, and white rays, which are not long, but rather numerous. The florets of the disk are also plentiful.

32. *S. petiolaris*. Latc-flowered Golden-rod. Ait. ed. 1.

v. 3. 216. ed. 2. n. 17. Willd. n. 24. Pursh n. 28.—Stem erect, villous. Leaves elliptical, roughish, stalked. Clusters erect. Rays twice the length of the calyx.—In dry sandy soil, from New Jersey to Carolina, flowering from September to November.—The stem is branched, round, hoary like the leaves, especially their ribs. The larger leaves are rather above an inch in length; those which plentifully clothe the flower-branches are much smaller; all are nearly entire. Clusters numerous, erect, short, of few, but rather large, flowers, with a conspicuous yellow radius.

33. *S. stricta*. Willow-leaved Golden-rod. Ait. ed. 1. v. 3. 216. ed. 2. n. 18. Willd. n. 25. Pursh n. 29.—“Stem erect, smooth. Stem-leaves lanceolate, entire, smooth, rough-edged; radical ones serrated. Clusters panicled, erect. Flower-stalks smooth.”—In sandy woods, from New Jersey to Carolina, flowering from August to November.—About two feet high, very smooth. *Pursh*. Panicle with erect, simple, close branches. *Willd*.

34. *S. lanceolata*. Grass-leaved Golden-rod. Linn. Mant. 114. Willd. n. 26. Ait. n. 19. Pursh n. 30. (*Chrysocoma graminifolia*; Linn. Sp. Pl. 1178.)—Stem smoothish, furrowed, much branched. Leaves almost linear, entire, roughish, nearly erect, with three or five rough ribs. Corymbs terminal, level-topped. Flowers capitate. Rays not longer than the disk.—In fields and meadows, by the sides of woods and rivers, from Canada to Pennsylvania, flowering from September to November. This plant has been found in Scotland, on the banks of the Esk, a mile above Musselburgh, among willows, alders, &c. by Mr. E. J. Maughan of Edinburgh, in September 1809. Still we have not ventured to admit into the British list, a plant often met with in gardens, and very rapid in propagation, though many have been admitted on far less sufficient grounds. The stems are four or five feet high, branched in a corymbose manner, leafy, angular or furrowed, slightly rough, or quite smooth. Leaves sessile, grass-green, two inches or more in length, a quarter of an inch in breadth, roughish, especially at the edges and ribs. Flowers numerous, rather small, densely corymbose, yellow. Calyx ovate, smooth, shining, with tumid green-tipped scales.

35. *S. tenuifolia*. Narrow-leaved Golden-rod. Pursh n. 31. (*S. lanceolata* β , minor; Michaux Boreal-Amer. v. 2. 116.)—“Stem rough, angular, branched, corymbose. Leaves spreading, linear, very narrow, slightly three-ribbed, rough, with axillary tufts of smaller ones. Corymbs terminal, level-topped. Flowers capitate. Rays scarcely exceeding the disk.”—In “pine-barrens,” from New Jersey to Carolina, flowering in September and October. Not above a foot high. Leaves very small and narrow. *Pursh*.

36. *S. Sarothræ*. Close-leaved Dwarf Golden-rod. Pursh n. 32.—“Stem angular, rough; naked in the lower part; corymbose above. Branches with a few terminal flowers. Leaves linear, close-pressed, obscurely three-ribbed, rough on both sides, without axillary tufts. Rays twice the length of the disk.”—Gathered by governor Lewis, on the plains of the Missouri, flowering in September.—About a span high, resembling the *Sarothra gentianoides* of Linnæus, *Hypericum Sarothra* of Pursh, very much in general habit. This and the two preceding have a great affinity to one another, but Mr. Pursh considers them good and permanent species, as there are no intermediate varieties, which might lead to a suspicion that all belong to one genuine species. We have seen neither of the two last.

37. *S. cæsia*. Maryland Golden-rod. Linn. Sp. Pl. 1234. Willd. n. 27. Ait. n. 20. Pursh n. 33. (*Virga aurea marilandica cæsia glabra*; Dill. Elth. 414. t. 307. f. 395.)—Stem nearly erect, very smooth and even. Leaves lanceolate, smooth, with roughish edges and ribs. Clusters erect.

Rays

Rays rather longer than the disk.—In woods and low fields, from New England to Carolina, flowering from August to October. *Pursh.* The *stem* is upright, but somewhat zig-zag, branched, leafy, destitute of any furrows or other inequalities. *Leaves* about two inches long, pointed, nearly or quite entire, rather glaucous; paler beneath. *Clusters* numerous, short, with rough stalks, and small, smooth, awl-shaped *bracteas*.

38. *S. livida*. Livid Golden-rod. Willd. Enum. 891. Pursh n. 34.—“Stem smooth, panicled. Leaves lanceolate, ferrated, smooth, rough-edged. Branches racemose at the extremity. Rays elongated.”—In sandy fields and woods, from New York to Virginia, flowering in September and October. *Pursh.* *Stem* branched, dark purple, smooth. *Leaves* tapering at each end. Akin to *S. cæsia* in the colour of the *stem*, but different in having a panicled *stem*, whose *branches* are racemose at the summit. Willdenow. We are unacquainted with any thing answering to this description.

39. *S. hispida*. Hispid Golden-rod. Willd. n. 28. Pursh n. 35.—“Stem erect, rough with bristles. Leaves lanceolate, rough, entire; the radical ones ferrated. Clusters erect. Rays of a middling length.”—In grassy fields and woods, from New Jersey to Virginia, flowering in October and November.—Resembles *S. cæsia*. *Pursh.*

40. *S. hirta*. Hairy Golden-rod. Willd. Enum. 891. Pursh n. 36.—“Stem panicled, hairy. Leaves lanceolate, rough on both sides; those of the stem ferrated; of the branches entire. Clusters erect. Rays elongated.”—Native of North America, according to Willdenow, on whose authority alone it finds a place in the work of Mr. Pursh. It is said to be sufficiently distinguished by the hairy *stem*, and rough *leaves*, of which such as grow on the principal stem are deeply and sharply ferrated.

41. *S. lithospermifolia*. Gromwell-leaved Golden-rod. Willd. Enum. 892. Pursh n. 37.—“Stem branched, downy. Leaves lanceolate, rough on both sides, tapering, three-ribbed, entire. Clusters erect. Rays elongated.”—In sandy barren woods, from New Jersey to Carolina, flowering from August to October. *Pursh.* Willdenow says the *leaves* are much like *Lithospermum officinale*.

42. *S. levigata*. Flethy-leaved Golden-rod. Ait. ed. 1. v. 3. 215. ed. 2. n. 21. Willd. n. 29. Pursh n. 38.—Stem erect, smooth. Leaves lanceolate, fleshy, entire, smooth in every part. Clusters panicled, erect. Flower-stalks scaly, hairy. Radius twice the length of the calyx.—In salt-marshes, from Canada to Virginia, flowering from September to November.—A tall robust species, resembling the following one very much, and probably nothing more than a variety. *Pursh.* This opinion seems to us very correct, there being really no difference between the two plants, except the hairiness of the *flower-stalks* in the present, and its flowering about three months later than *S. mexicana*.

43. *S. mexicana*. Mexican Golden-rod. Linn. Sp. Pl. 1234. Willd. n. 30. Ait. n. 22. Pursh n. 39. (*Virga aurea mexicana*; Bauh. Pin. 517. *V. aurea mexicana*, *limonii folio*; Dodart. Mem. ed. Amst. 629. t. 36.)—Stem oblique, smooth. Leaves lanceolate, somewhat fleshy, entire, smooth in every part. Clusters panicled, erect. Flower-stalks scaly, smooth. Rays longer than the calyx.—On the banks of rivers and ditches in North America, near salt-water, flowering from July to September.—Tall; *flowers* large. *Pursh.* This is smooth and even in every part, and of a rather fleshy, somewhat glaucous habit, approaching to our *Aster Tripolium*, whose place it occupies in America. The radical *leaves* are large, obovate, on long stalks. *Bracteas* numerous, lanceolate, keeled, recurved, of a thin, scaly, or squarrose, aspect, smooth, exactly like the last, but the

flower-stalks are equally smooth, which in that are very rough with short hairs. *Flowers* rather large.

44. *S. viminea*. Twiggy Golden-rod. Ait. ed. 1. v. 3. 215. ed. 2. n. 23. Willd. n. 31. Pursh n. 40. (*S. integerrima*; Mill. Dict. ed. 8. n. 24.)—Stem erect, slightly downy. Leaves linear-lanceolate, smooth, rough-edged; tapering at the base: the lower ones somewhat ferrated. Clusters erect. Rays elongated.—On the banks of rivers and ditches, from Canada to Virginia, flowering from August to October. *Pursh.*—Akin to the two last, but the *leaves* are thin or membranous, not succulent; their margin furnished with little inflexed rigid bristles. *Flower-stalks* and *branches* angular and very rough. *Bracteas* lanceolate, recurved, smooth. *Flowers* numerous, the size of the preceding.

45. *S. erecta*. Erect Golden-rod. “Bank. MSS.” Pursh n. 41.—“Stem rather villous. Leaves lanceolate, veiny, smooth, entire, somewhat stalked.”—Native of North America. *Herb. Banks. Pursh.*

46. *S. macrophylla*. Long-leaved Golden-rod. “Bank. MSS.” Pursh n. 42.—“Lower leaves ovate, pointed, tapering, unequally and sharply ferrated, smooth; those of the stem lanceolate, tapering at each end, ferrated, nearly sessile. Clusters axillary, stalked, leafy, the length of the leaves. Calyx oblong, turgid, many-flowered. Rays somewhat elongated.”—In Canada. About three feet high. Intermediate between this genus and *Aster*. *Pursh.*

47. *S. glomerata*. Round-headed Golden-rod. Michaux Boreal-Amer. v. 2. 117. Pursh n. 43.—“Stem low, quite simple. Leaves smooth, oblong-lanceolate, ferrated. Cluster simple, formed of round axillary heads; the uppermost crowded. Calyx turgid, many-flowered.”—Found by Michaux on the mountains of Carolina. No other botanist seems acquainted with this species, nor is it easy to understand his definition of the leaves; (“*foliis longè latèque lanceolatis*.”)

48. *S. flexicaulis*. Crooked-stalked Golden-rod. Linn. Sp. Pl. 1234. Willd. n. 32, α . Ait. n. 24, α . Pursh n. 44, α . (*Virga aurea montana*, *scrophulariæ folio*; Pluk. Phyt. t. 235. f. 3.)—Stem zig-zag, roundish, smooth. Leaves lanceolate, pointed, ferrated, smooth, nearly sessile. Clusters axillary, erect.—In woods and fields, from Canada to Carolina, flowering from August to October. *Pursh.* The *stem* is slender, zig-zag, purplish, smooth and even; mostly round; occasionally somewhat angular. *Leaves* numerous, alternate, on very short broad *stalks*, lanceolate, from one and a half to two inches long, half an inch wide, ferrated, rough-edged, very smooth on both sides; paler beneath, somewhat contracted and entire in their lower half; the upper ones sometimes nearly entire. *Clusters* much shorter than the leaves, oblong, with hairy *stalks*, and ovate, smooth, veiny *bracteas*; the upper ones very short, and nearly capitate. *Radius* pale yellow, half as long again as the calyx.

49. *S. latifolia*. Broad-leaved Axillary Golden-rod. Linn. Sp. Pl. 1234. (*S. flexicaulis* β ; Willd. n. 32. Ait. n. 24. Pursh n. 44. *Virga aurea canadensis asterifci folio*; Herm. Parad. 244. t. 244.)—Stem somewhat zig-zag, angular, smooth. Leaves ovate, pointed, strongly ferrated, smooth; tapering into a winged footstalk. Clusters axillary, erect.—In woods and fields from Canada to Carolina, flowering from August to October. *Pursh.* Very different in appearance from the last, to which it is united by various authors, on the authority of the *Hortus Kewensis*. But we suspect the real *flexicaulis* is not much understood in England, what we have under that name from Kew garden, as well as the Bankian herbarium, being really the *latifolia*, which latter species was not known, as such, to the botanists here,

here, till the Linnæan herbarium came among them. How far it may be specifically distinct, we cannot be certain. We have specimens of both from the late Rev. Dr. Muhlenberg, whose *leaves* differ greatly. Those of *latifolia* are two inches broad, with very copious, deep, acute serratures, and contract at the base, more or less suddenly, into a winged *footstalk*, near an inch long. Their rib, and under side, are sometimes hairy. Nothing like this is seen in *flexicaulis*. We suspect Plukenet's t. 235. f. 4, as well as f. 3, may belong to this last; see the following. Hermann's plate is certainly *latifolia*. Mr. Pursh speaks of these species collectively, as the most common *Solidago* in North America. We know not to which of the two this is most applicable.

50. *S. ambigua*. Angular-stalked Golden-rod. Ait. ed. 1. v. 3. 217. ed. 2. n. 25. Willd. n. 33. (*Virga aurea latissimo folio, canadensis, glabra*; Pluk. Phyt. t. 235. f. 4?)—Stem slightly zig-zag, smooth, angular, branched. Leaves ovato-lanceolate, pointed, densely serrated, rather hairy beneath; tapering into a winged footstalk; upper ones entire. Clusters axillary, erect; the upper ones much longer than the leaves.—Cultivated by Miller, and communicated from Kew garden to the younger Linnæus. It is said to flower in July and August, but its native country is unknown, nor has Mr. Pursh met with this plant in America. It may be a variety of *latifolia*, from which it differs in having somewhat narrower leaves, and in the much greater length of the upper clusters of flowers, which combine to form a close panicle. Plukenet's figure, cited here with doubt, does not quite enough express this, nor are so many of the leaves entire, though several of the upper ones are so in our specimen.

51. *S. alpestris*. Alpine Golden-rod. "Waldst. and Kitaib. Hung." Willd. n. 34.—"Stem erect, smooth. Leaves elliptic-lanceolate; the lower ones serrated. Clusters erect, close, shorter than the leaves. Rays elongated."—Native of the Carpathian, Austrian, and Bohemian alps. Very like the following, but the *stem-leaves* are elliptic-lanceolate, nearly entire, and the *stem* is smooth. It varies greatly by culture, becoming two feet, instead of one, in height, and branched, instead of quite simple. The leaves of the wild plant measure from half an inch to an inch and a half, (we presume in length); those of the garden one from one and a half to three inches. The upper clusters of the former are crowded into a sort of spike; those of the latter are axillary, and composed of few flowers. Willdenow.

52. *S. Virgaurea*. Common Golden-rod. Linn. Sp. Pl. 1235. Willd. n. 35. Ait. n. 26. Pursh n. 46. Fl. Brit. n. 1. Engl. Bot. t. 301. Fl. Dan. t. 663. (*S.* n. 69; Hall. Hist. v. 1. 29. *Virga aurea*; Ger. Em. 430. Camer. Epit. 748, 749. Matth. Valgr. v. 2. 354.)

β. *Virga aurea, longo, molli, et lanceolato folio, alpina*; Bocc. Mus. 34. t. 30.

γ. *Virga aurea montana minor*; Bocc. Mus. 169. t. 118. Barrel. Ic. t. 783.

δ. *Solidago cambrica*; Hudf. 367. Ait. n. 27. Willd. n. 36. (*Virga aurea cambrica, floribus conglomeratis*; Dill. Elth. 413. t. 306. f. 393.)

ε. *S. minuta*; Linn. Sp. Pl. 1235. Willd. n. 38. Ait. n. 29. (*Virga aurea omnium minima, floribus maximis*; Herm. Parad. 245. t. 245. *V. aurea montana biuncialis pumila, foliis acuminatis*; Pluk. Phyt. t. 235. f. 7; and *foliorum apicibus obtusis*; f. 8.)

Stem somewhat zig-zag, angular, hairy. Leaves more or less serrated, roughish; tapering at the base. Clusters paniced, erect, close. Rays twice the length of the calyx.—Native of bushy, heathy, mountainous, and alpine situ-

ations throughout Europe, as well as at Labrador, and even China, flowering in the latter part of summer. The root is perennial, consisting of long simple fibres. Stem very variable in height and luxuriance, mostly from one to three feet high, and branched in a paniced manner, more or less zig-zag, never quite straight, leafy, angular, covered more or less with short hairs, especially the upper part; rounder, and frequently purplish, at the base. Leaves elliptic-lanceolate, or nearly ovate, roughish, firm and rather rigid; the lower ones stalked; the rest variously elongated at the base; all extremely variable in size, and especially in their serratures, which, though commonly close and shallow, are sometimes very coarse and tooth-like, sometimes nearly wanting; the margin is always rough with minute bristly hairs; the surface smooth or rough; the under side rather paler; sometimes the upper leaves are recurved, or drooping, and the uppermost of all gradually diminish into bracteas. Panicle terminal, many-flowered, attended by small leaves; its lower branches often axillary; all downy, racemose, or corymbose; now and then simple and single-flowered. Scales of the calyx at length spreading, but all straight, imbricated, lanceolate, fringed, membranous at the edges; sometimes rough at the back. Florets of the radius from five to nine or ten, of a golden yellow, spreading, elliptic-oblong, toothed at the end, their limb the length of the calyx.—We scarcely know a plant more difficult to define or to understand than this, nor can we limit even the varieties so as to make them intelligible; much less elevate them to the rank of species. *β*, sent from Italy by Arduino to Linnæus, is more downy, with more pliant leaves, than our common kind, with numerous axillary clusters, and a more leafy panicle. The flowers are considerably larger than usual.

γ has equally large flowers, but much fewer, so that the panicle is nearly simply racemose, and the leaves are coarsely serrated. We have Swiss specimens of Haller's n. 69, which combine these two varieties, and whose herbage connects them with the common state of the species.

δ is equally simple in its panicle, and its growth is more humble, but the most authentic specimens prove it a mere variety. It is impossible to say what Willdenow had for *S. cambrica*, which he asserts to remain unchanged by culture; but his authority falls to the ground, since he persists in quoting Petiver's t. 16. f. 11, which we have pointed out in Fl. Brit. as a copy of Camerarius, t. 748, done for the common *Virgaurea*!

ε is the most puzzling of all. The flowers in Hermann's plate nearly equal those of our *β*; while in the Linnæan specimen, evidently, as Linnæus judged it, a variety of *Virgaurea*, they are but half as large, and paniced. This specimen was sent by Arduino for Boccone's t. 118, (see variety *γ*;) which it very little resembles. Plukenet's figures have the chiefly axillary inflorescence of our *β*, only each stalk is simple, not racemose.—If any of these varieties are to be established as species, it must be from far better materials than have fallen in our way, and by widely different characters than have as yet been given. We must observe that Grew's t. 59, cited by Haller, is evidently one of the garden American species, totally unlike *Virgaurea*.

53. *S. multiradiata*. Labrador Golden-rod. Ait. ed. 1. v. 3. 218. ed. 2. n. 28. Willd. n. 37. Pursh n. 47.—"Stem rather villous. Leaves sessile, lanceolate, smooth, fringed; the lower ones serrated at the end. Cluster terminal, erect. Rays numerous, elongated."—Found at Labrador and Hudson's Bay, flowering from August to October.—Pursh. —Stem a span high, downy, erect, quite simple. Leaves narrow, nearly entire. Cluster dense. Radius narrow, copious. Willdenow.

54. *S. humilis*. Humble Golden-rod. Pursh n. 48.—“Stem simple, erect, smooth. Leaves lanceolate, ferrated, smooth; tapering and elongated at the base. Clusters erect.”—Native of North America, according to the Banksian herbarium. *Pursh*.

55. *S. elata*. Lofty Golden-rod. Pursh n. 49.—“Stem hairy, round. Leaves lanceolate; rather hairy beneath. Clusters erect. Rays elongated.”—Native of North America, according to the same authority. *Pursh*.

56. *S. rigida*. Hard-leaved Golden-rod. Linn. Sp. Pl. 1235. Willd. n. 39. Ait. n. 30. Pursh n. 50. (*Virga aurea* Novæ Angliæ, lato rigido folio; Herm. Parad. 243. t. 243.)—Leaves ovate-oblong, rough, like the corymbose stem, with minute rigid hairs; the lowermost ferrated; upper entire. Clusters compact. Rays twice the length of the obtuse calyx.—In the tract of mountains from New Jersey to Carolina, flowering from August to October. *Pursh*. The stem is four or five feet high, round, striated, leafy, rough with copious rigid pubescence, and branched copiously, in a corymbose manner, at the top. Leaves rough like a file, somewhat hoary; the radical ones stalked, a foot long, broad, pointed, ribbed, more or less ferrated; the rest from one to four inches long, either obtuse or somewhat pointed, entire, or occasionally crenate; those on the flowering branches numerous, small, and entire. Flowers rather large, but various in size. Scales of the calyx blunt, or rounded at the end, ribbed, membranous at the edge, variable in breadth.—A Pennsylvania specimen, sent by the late Dr. Muhlenberg, has crenate, exactly ovate, leaves on the stem, and flowers about half the usual size; but we dare not make it a distinct species.

57. *S. noveboracensis*. New York Golden-rod. Linn. Sp. Pl. 1235. Willd. n. 40. Pursh n. 51.—Radical leaves elliptic-oblong, stalked, rough. Stem almost naked, branched, furrowed, level-topped. Rays twice as long as the taper-pointed calyx.—In sandy fields and woods of North America, flowering in September and October. *Pursh*. The root is thick and somewhat woody. Stem one and a half or two feet high, stout, rough, round, plentifully furrowed, quite erect, bearing two or three oblong-lanceolate leaves at the origin of the flowering branches, but otherwise naked. Leaves chiefly radical, on long, erect stalks, elliptical, tapering at each end, three inches long, rough like a file with minute tubercles, the margin furnished with shallow serratures. Flowers large, not numerous, on corymbose hairy stalks, with a few rough lanceolate bracteas. Calyx-scales narrow, purplish, downy, with long tapering points. The radiant florets appear to be sometimes more than ten. The seeds are hairy; their down long, very slender, minutely rough. This species appears to be a stranger in our gardens. Its habit is that of an *Aster*.

SOLIDAGO, in *Gardening*, contains plants of the tall, herbaceous, flowering, perennial kind, of which the species cultivated are; the common golden-rod (*S. virgaurea*); the Canadian golden-rod (*S. canadensis*); the tall golden-rod (*S. altissima*); the Mexican golden-rod (*S. mexicana*); the twiggly golden-rod (*S. viminea*); the two-coloured golden-rod (*S. bicolor*); the hard-leaved golden-rod (*S. rigida*); the Maryland golden-rod (*S. cæsia*); the crooked-stalked golden-rod (*S. flexicaulis*); and the narrow-leaved evergreen golden-rod (*S. sempervirens*).

The first sort has sometimes the names of Wound-wort and Aaron's rod. There are several varieties of it, as the purple-stalked broad-leaved, which has the stalks stiff, purplish-brown, two feet high; the panicles axillary and terminating; each flower on a long slender footstalk, pale yellow, appearing at the beginning of August; the leaves

lanceolate, almost four inches long, and a quarter of an inch broad, deeply ferrate, pale green beneath.

The common golden-rod, which has the lower leaves ovate-lanceolate, two inches long and an inch broad, slightly ferrate, on pretty long footstalks; the stems slender, a foot and a half high; with small, narrow, entire, sessile leaves; the flowers in panicked bunches, clustered together, forming a thick erect spike, appearing in August and September. The narrow-leaved, which has the stalk round, smooth, a foot and a half high; the leaves narrow-lanceolate, an inch and a quarter long, and an eighth of an inch broad, almost entire, sessile; the flowers in small clustered bunches from the axils, to which they fit very close; and the stalk is terminated by a roundish bunch. The dwarf golden-rod, which has the lower leaves indented; the stalk seldom more than a foot high, branching out almost from the bottom; the branches terminated by short, clustered, erect spikes; the leaves on the stem and branches very narrow, acute-pointed, and entire. The Welsh golden-rod, which has the lower leaves narrow-lanceolate, an inch and half long, and a quarter of an inch broad, smooth, slightly ferrate, a little hoary on the under side; the stalk about six inches high, with the same sort of leaves on it, only smaller; the flowers in roundish clustered terminating spikes, much larger than those of the common sort, and appearing five or six weeks earlier in the season.

In the third sort there are several varieties; as the tallest golden-rod, the hairy golden-rod, the recurved golden-rod, the Virginia golden-rod.

Method of Culture.—These plants are all readily increased by slipping or parting the roots, and planting them out in the autumn or winter soon after their stems decay, or very early in the spring before they begin to shoot, but the former is the better season, in the places where they are to grow; they succeed in almost any soil or situation, and afterwards require only to be kept clean from weeds, and to have the decayed stems cut down when they begin to decay in the autumn. When they have increased considerably in the roots, they should always be slipped as above.

These plants are very hardy and durable in their roots, by which most of them soon become large, the small slips not unfrequently growing into large bunches in one season, many of them, of course, require to be well cut in with a sharp spade all round about their roots annually, or nearly so, to prevent their spreading too greatly and having an improper appearance, as well as being injurious to other neighbouring plants of small growth.

In planting out they require much room, as they spread considerably. But they afford considerable variety and ornament in larger borders and clumps, on all pleasure-grounds towards the autumnal season.

SOLIDAGO, in the *Materia Medica*. The flowers and the leaves of the common golden-rod, or *virga aurea*, have a slightly aromatic odour, and a subastrigent somewhat aromatic taste. Boiling water extracts the active matter. The infusion changes slightly to green syrup of violets, and precipitates sulphate of iron black. Golden-rod is astrigent, and has been regarded as lithontriptic. It may be, says Thomson (*Disp.*), of some use in a weakened state of the viscera, and, like other tonics, beneficial in calculous habits, but it is not entitled to much notice. The dose of the powdered leaves and flowers may be from grs. x to 3j or more.

SOLIDAR, in *Geography*, a town of Bengal; 26 miles S.S.W. of Ragonatpour.

SOLIDITY, in *Physics*, a property of matter or body,

SOLIDITY.

by which it excludes every other body from that place which itself possesses.

Solidity, in this sense, is a property common to all bodies, whether solid or fluid. It is usually called *impenetrability*; but solidity expresses it best, as carrying somewhat more of positive with it than the other, which is a negative idea.

The idea of solidity, Mr. Locke observes, arises from the resistance we find one body make to the entrance of another into its own place. Solidity, he adds, seems the most extensive property of body, as being that by which we conceive it to fill space; it is distinguished from mere *space*, by this latter not being capable of resistance or motion.

It is distinguished from *hardness*, which is only a firm cohesion of the solid parts, so as they may not easily change their situation.

The difficulty of changing situation gives no more solidity to the hardest body than to the softest; nor is a diamond properly a jot more solid than water. By this we distinguish the idea of the extension of body from that of the extension of space: that of body is the continuity or cohesion of solid, separable, moveable parts; that of space, the continuity of unsoft, inseparable, immoveable parts.

The Cartesians, however, will, by all means, deduce solidity, or, as they call it, *impenetrability*, from the nature of extension; they contend that the idea of the former is contained in that of the latter; and hence they argue against a vacuum. Thus, say they, one cubic foot of extension cannot be added to another, without having two cubic feet of extension; for each has in itself all that is required to constitute that magnitude. And hence they conclude, that every part of space is solid, or impenetrable, inasmuch as of its own nature it excludes all others. But the conclusion is false, and the instance they give follows from this, that the parts of space are immoveable, not from their being impenetrable or solid.

For an account of a late controversy concerning the solidity of matter, see MATTER.

SOLIDITY, in *Geometry*, the quantity of space contained in a solid body; called also the *solid content*, and the cube of it.

The solidity of a cube, prism, cylinder, or parallelepiped, is had by multiplying its basis into its height.

The solidity of a pyramid or cone is had by multiplying either the whole base into a third part of the height, or the whole height into a third part of the base.

SOLIDITY of any irregular Body, To find the. Put the body in a hollow parallelepiped, and pour water or sand upon it, and note the height of the water or sand AB (*Plate XIV. Geometry, fig. 2.*); then taking out the body, observe at what height the water (or sand, when levelled) stands, as AC. Subtract AC from AB, the remainder will be BC. Thus is the irregular body reduced to a parallelepiped, whose base is FCGE, and its altitude BC. To find the solidity of which, see PARALLELEPIPED.

Suppose, *e. gr.* AB to be 8, and AC, 5; then will BC be 3: suppose, again, DB, 12, DE, 4; then will the solidity of the irregular body be found 144.

If the body be such as that it cannot be well laid in such a kind of channel, *e. gr.* if it be required to measure the solidity of a statue, as it stands; a quadrangular prism or parallelepiped is to be framed over it; the rest as before.

SOLIDITY of a hollow Body, To find the. If the body be not comprised in the number of regular bodies, its solidity is found as in the preceding problem. If it be a parallelepiped, prism, cylinder, sphere, pyramid, or cone, the solidity first of the whole body, including the cavity, then that of the cavity, which is supposed to have the same figure

with the body itself, is to be found, according to the respective methods delivered under PARALLELEPIPED, PRISM, &c. For the latter being subtracted out of the former, the remainder is the solidity of the hollow body required.

For the centrobaryc method of measuring the solidity of bodies, see CENTROBARYC Method.

To find the Solidity of Bodies by the Method of Fluxions. Let ABC (*Plate XIV. Analysis, fig. 1.*) represent any solid conceived to be generated by a plane PQ, passing over it with a parallel motion: let Hh, perpendicular to PQ, be taken to express the fluxion of AH (*x*), or the velocity with which the generating plane is carried: also let the area of the part EmFn be denoted by A: then it follows, from the definition of a fluxion, that the fluxion of the solid AEF will be expressed by A \dot{x} . Whence, by expounding A in terms of *x* (according to the nature of the figure), and then taking the fluent, the contents of the solid, which we may represent by *s*, will be given. But, when the proposed solid is that arising from the revolution of any given curve AEB about AHD, as an axis, the fluxion (*s*) of the solidity may be exhibited in a manner more convenient for practice; for, putting the area (3.141592, &c.) of the circle, whose radius is unity, = *p*, and the ordinate EH = *y*, it will be $1^2 : y^2 :: p : py^2$, the area of the circle EmFn, which being substituted for A, we have $\dot{s} = py^2 \dot{x}$.

Ex. 1. To find the Content of a Cone ABC (*fig. 2.*) Let the given altitude AD be = *a*, and the semidiameter of its base BD = *b*, and the distance AF of the circle EG from the vertex A, = *x*; then we shall have, by

similar triangles, $a : b :: x : EF (y) = \frac{bx}{a}$. Whence

$\dot{s} (= py^2 \dot{x}) = \frac{pb^2 x^2 \dot{x}}{a^2}$; and, consequently, by the inverse method of fluxions, $s = \frac{pb^2 x^3}{3a^2}$; which, when $x = a$

(= AD), gives $\frac{pb^2 a}{3} = p \times BD^2 \times \frac{1}{3} AD$ for the

content of the whole cone ABC; which appears, from hence, to be just $\frac{1}{3}$ d of a cylinder of the same base and altitude. See CONE.

Ex. 2. To find the Content of a Spheroid AFBH (*fig. 3.*) and also of a Sphere. Let the axis AB, about which the solid is generated, be = *a*, and the other axis FH of the generating ellipse = *b*; it follows, from the property of the ellipse, that $a^2 : b^2 :: x (a - x) (AD \times BD) : y^2 (DE^2) = \frac{b^2}{a^2} (ax - xv)$: whence we have

$s (= py^2 \dot{x}) = \frac{pb^2}{a^2} (ax \dot{x} - x^2 \dot{x})$, and $s = \frac{pb^2}{a^2} (\frac{1}{2} axx$

$- \frac{1}{3} x^3) =$ the segment AIE. Which, when AD (*x*)

= AB (*a*), becomes $\frac{pb^2}{a^2} (\frac{1}{2} a^3 - \frac{1}{3} a^3) = \frac{pb^2}{a^2} \times \frac{a^3}{6} =$

$\frac{1}{6} p a b^2 =$ the content of the whole spheroid. Where, if *b* (FH) be taken = *a* (AB), we shall obtain $\frac{1}{6} p a^3$ for the true content of a sphere whose diameter is *a*. Hence, a sphere, or a spheroid, is $\frac{1}{6}$ ds of its circumscribing cylinder;

for the area of the circle FH being expressed by $\frac{pb^2}{4}$, the

content of the cylinder, whose diameter is FH, and altitude

side AB, will, therefore, be $\frac{pb^2a}{4}$, of which $\frac{1}{2}pab^2$ is evidently two third parts. See SPHERE and SPHEROID.

Ex. 3. To find the Content of a parabolic Conoid. From the equation $a^{m-n}x^n = y^m$ of the generating curve, we

obtain $y = a^{\frac{m-n}{m}} \times x^{\frac{n}{m}}$, and $\dot{s} (= py^2\dot{x}) = pa^{\frac{2m-2n}{m}} \times x^{\frac{2n}{m}+1}$;
 and, therefore, $s = pa^{\frac{2m-2n}{m}} \times \frac{x^{\frac{2n}{m}+1}}{\frac{2n}{m}+1} = pa^{\frac{2m-2n}{m}} \times \frac{mx^{\frac{2n}{m}+1}}{2n+m}$
 $= py^2 \times \frac{mx}{2n+m} =$ the content of the solid; which,

therefore, is to py^2x , the content of the circumscribing cylinder, as m to $2n + m$. Whence the solid generated by the conical parabola (in which $m = 2$, and $n = 1$) appears to be just half of its circumscribing cylinder. See PARABOLIC Conoid.

Ex. 4. To find the Content of an hyperbolic Conoid. From the equation $y^2 = \frac{b^2}{a^2}(ax + xx)$ of the generating hyper-

bola, we have $\dot{s}(py^2\dot{x}) = \frac{pb^2}{a^2}(ax\dot{x} + x^2\dot{x})$, and consequently $s = \frac{pb^2}{a^2}(\frac{1}{2}ax^2 + \frac{1}{3}x^3) =$ the content of the conoid; which, therefore, is to $(\frac{pb^2}{a^2}(ax + x^2)x)$ that of

a cylinder of the same base and altitude, as $\frac{1}{2}a + \frac{1}{3}x$ to $a + x$. This ratio, if x be very small, will become as 1 to 2 very nearly: whence it may be inferred, that the content of a very small part of any solid generated by a curve, whose radius of curvature at the vertex is a finite quantity, is half that of a cylinder of the same base and altitude very nearly; because any such curve, for a small distance, will differ insensibly from an hyperbola, whose radius of curvature, at the vertex, is the same.

Ex. 5. To find the Content of a parabolic Spindle, generated by the Rotation of a given Parabola ACB (fig. 4.) about its Ordinate AB. Put CM, the abscisse of the given parabola, = a , and the femi-ordinate AM (or BM) = b ; and supposing ENF to be any section of the solid parallel to DC, let its distance MN or EP from DC be denoted by ω : then, by the property of the curve, we shall have

$AM^2 (b^2) : EP^2 (\omega^2) :: CM (a) : CP = \frac{a\omega^2}{b^2}$: therefore EN (= CM - CP) = $a - \frac{a\omega^2}{b^2} = \frac{a(b^2 - \omega^2)}{b^2}$,

and consequently $p \times EN^2 = \frac{pa^2}{b^4}(b^4 - 2b^2\omega^2 + \omega^4)$

= the area of the section EF: which, multiplied by $\dot{\omega}$, the fluxion of MN, gives $\frac{pa^2}{b^4}(b^4\dot{\omega} - 2b^2\omega^2\dot{\omega} + \omega^4\dot{\omega})$ for the fluxion of the solidity, whose fluent $\frac{pa^2}{b^4}(b^4\omega - \frac{2}{3}b^2\omega^3 + \frac{1}{5}\omega^5)$, when ω becomes = b , is $(\frac{8pa^2b}{15})$ half the content of the solid. See PYRAMOID.

For other examples of a similar kind, see Simpson's Fluxions, vol. i. sect. 9, and other elementary treatises on that subject.

SOLIDITY, in *Architecture*, is applied both to the consistence of the ground on which the foundation of a building is laid, and to a mass of masonry of extraordinary thickness, without any cavity within. The solidity of the Egyptian pyramids is inconceivable.

SOLIDS, in *Anatomy*, &c. denote all the continuous and continent parts of the body; thus called, in opposition to the fluids, or parts contained in them.

Of the solid kind, are the bones, cartilages, ligaments, membranes, fibres, muscles, tendons, arteries, veins, nerves, glands, lympheducts, and lacteals.

SOLIDUS, in *Ancient Coinage*. (See AUREUS.) According to Pliny's account, gold was coined at Rome sixty-two years after silver, *i. e.* 547 U. C. or B. C. 204; and then the seruple passed, as he informs us, for 20 sesterces. It was afterwards thought proper to coin 40 pieces out of the pound of gold; and, as he says, our princes have, by degrees, diminished their weight to 45 in the pound. The pieces that now remain confirm Pliny's account. In the first coinage, the aurei were 48 in the pound; afterwards, as Pliny says, there were 40 in the pound, and the aureus was raised from 106 grains, the weight of the didrachm of this coinage, to 126 grains. From Pliny and the coins it appears, that in the first coinage, the seruple of gold passed for 20 sesterces; the drachm of three seruples was 60 sesterterii, or 15 silver denarii; and the didrachm, or aureus, the common Roman gold coin, was worth 30 silver denarii, equal to 1*l.* sterling; gold being 10 silver as 17*½* to 1. The aureus seems to have continued at 30 silver denarii till Sylla's time; but about the year of Rome 675, B. C. 77, the aureus fell to the rate of 40 in the pound, as Pliny informs us, and being reduced near the scale of the Greek χρυσος, passed for 20 denarii, as the later for 20 drachmas, being in currency 13*s.* 4*d.* English. This is the more probable, because we know from Suetonius, that the great Cæsar brought so much gold from Gaul, that it sold at 3000 nummi a pound, that is, nine times its weight in silver; but the Gallic gold was of a very base sort. However, in the reign of Claudius, the aureus passed for 100 sesterterii, or 25 silver denarii; at which rate it remained. This was 16*s.* 8*d.* English in currency; but valuing gold at 4*l.* an ounce, the intrinsic value of the aureus is about 1*l.* The aureus fell by degrees, as Pliny says, to 45 in the pound. From the coins it is clear, that it was in the time of the civil wars of Otho and Vitellius, that the aureus fell from 40 in the pound, or about 125 troy grains at a medium, to 45 in the pound, or about 110 grains of medial weight each. It continued of this standard till the time of Elagabalus, when it fell to about 92 grains at an average, or near 55 in the pound. That the aureus passed for 25 silver denarii down to Alexander Severus, is clear; and supposing that standard to remain, as we have no authority for a change till the time of Constantine I., the double aureus will have borne 50 silver denarii, and the aureus 25. The "triens" must have had eight silver denarii, and two denarii aurei; and the double triens, 16 silver denarii or argentei, and four denarii aurei. The denarius was not then worth above 14*s.* English. The only change Aurelian made in the money, was probably restricted to the gold; for it is certain that under him, and his successor Probus, the common gold piece, or aureus, is of 100 grains, a size confined to these two emperors. There are also halves of about 50 grains; and double aurei, commonly of very fine workmanship, of upward of 200 grains. Down to Constantine

Constantine I., the aureus stands at between 80 and 70 grains. This prince, who seems not to have altered the size of the coin, instead of the "aureus," gave the "solidus" of six in the ounce of gold, and caused it to pass for 14 of his new silver coins, called "Milliarenfes," and 25 denarii, as before; gold being to silver as about 14 to 1. The solidus, or chief gold coin, continued of the same standard to the very close of the Byzantine empire; for gold was common in Constantinople, while silver became more and more scarce. The solidus was worth 12s. sterling. In the days of the first emperors the aureus was worth 25 denarii, and gold to silver about 13½ to 1. The medial aureus was 110 grains, the denarius 60. That standard remained the same till the time of Alexander Severus, after which we have no data; but it is probable that Constantine took the value as he found it, and that from Alexander Severus to Constantine, if we except the short interval of the end of Aurelian's reign, and beginning of that of Probus, gold was rising in value till it exceeded 14 to 1. The gold coins, called "Bezants" in Europe, because they were sent from Byzantium, or Constantinople, were solidi of the old scale, six to the ounce. In Byzantine writers, the solidus is also called "Nomisma," or *the coin*; "Crysinos," because of gold; "Hyperperos," from its being refined with fire, or from its being of bright gold flaming like fire. The solidi also, like the aurei formerly, received names from the princes whose portraits they bore; as "Michelati," "Manuelati." Solidus is a term used for the aureus by Apuleius (*Met. lib. 10.*) who lived in the time of Antoninus the philosopher; nay, so early as in the Prætorian edicts of the time of Trajan; being thus distinguished from the semissis or half. In the time of Valerian, when aurei of different sizes had been introduced, it became necessary to distinguish the particular aurei that were meant.

In the first gold coinage at Rome, the aureus was divided into four inferior parts: the semissis, or half, of 60 sesterii; the tremissis, or third, of 40; the fourth, the name of which is not known, of 30; and the sixth, or scrupulum, of 20. But soon afterwards all these were dropped, except the semissis or half, which occurs in the times of the consuls, and of some emperors, but is extremely scarce, so that few must have been struck. This gold semissis, or half aureus, is termed "quinarius" by medallists with great propriety, and is very uncommon in all the consular and imperial times; but continued the only division of the aureus till the time of Alexander Severus. This prince, as Lampridius informs us, coined semisses and tremisses of gold; but none have yet been found. It is likely they were all recoined by his immediate successors, who again raised the tributes. He also proposed to issue quartarii, but did not live to accomplish his purpose. Trientes, or tremisses, of gold are, however, mentioned in rescripts of Valerian I., and actually exist, both of him and of his son Gallienus, weighing about 30 grains. The gold tremissis was the pattern of the early French and Spanish gold coins; as the silver denarius, in its diminished state, was that of the Gothic and Saxon penny. Pinkerton's Medals, vol. i.

SOLIEK ELSEID, in *Geography*, a town of Egypt, on the left bank of the Nile; 10 miles S. of Girgê.

SOLIFO, a town of Naples, in the province of Otranto; 9 miles E. of Nardo.

SOLIGNAC-*sur-Loire*, a town of France, in the department of the Upper Loire, and chief place of a canton, in the district of Le Puy; 13 miles S. of Le Puy. The town contains 880, and the canton 4455 inhabitants, on a territory of 150 kilometres, in 6 communes.

SOLIGNY, a town of France, in the department of the Orne; 6 miles N. of Mortagne.

SOLIGO, a town of Italy, in the Trevisan; 6 miles S.W. of Trevigio.

SOLIHULL, commonly pronounced *Silhill*, is situated in the division of the same name, in the hundred of Hemlingford, and county of Warwick, England. It is considered as a market-town, but the market is now in absolute disuse. Its distance from Birmingham is 7 miles, and from London 108 miles. Dugdale conjectures that the chief parts of the district, now included in the parish of Solihull, were known by the name of Ulverlei, at the time of the Norman survey. Here was formerly the principal seat of the barony of Limesie; and the residence of the barons he supposes to have occupied a spot at present called Olton, a small village about two miles north-west from Solihull. From the ruins of this baronial residence, and its dependent habitations, the town of Solihull is conjectured to have arisen. Grants for an annual fair and a weekly market were speedily procured; but the town does not appear to have obtained much distinction at any period. It bears the tranquil appearance of a large village, and contains little to attract the notice of travellers, except the church, which is a spacious edifice of the cruciform description. In the population return of the year 1811, the parish is stated to contain 528 houses, occupied by 2581 persons.

On an elevated site in the vicinity of Solihull, surrounded by spacious grounds, is Malvern-Hall, the mansion of Henry Grefwold Lewis, esq. Dugdale's Antiquities of Warwickshire. Beauties of England and Wales, vol. xv. Warwickshire, by J. N. Brewer.

SOLIKAMSK, a town of Russia, in the government of Perm, on the Kama, famous for its salt-works; 112 miles N. of Perm. N. lat. 59° 36'. E. long. 56° 13'.

SOLILOQUY, SOLILOQUIUM, a reasoning, or discourse, which a man holds with himself.

Papias says, that soliloquy is properly a discourse by way of answer to a question that a man has proposed to himself.

Soliloquies are become very common things on the modern stage; yet can nothing be more inartificial, or more unnatural, than an actor's making long speeches to himself, to convey his intentions, &c. to the audience.

Where such discoveries are necessary to be made, the poet should rather take care to give the dramatic persons such confidants, as may necessarily share their inmost thoughts; by which means, they will be more naturally conveyed to the audience. Yet is even this a shift an accurate poet would not be found to have occasion for.

The use and abuse of soliloquies is well delivered by the duke of Buckingham, in the following lines:

"Soliloquies had need be very few,
Extremely short, and spoke in passion too.
Our lovers talking to themselves, for want
Of others, make the pit their confidant:
Nor is the matter mended yet, if thus
They trust a friend, only to tell it us."—

SOLIMAGUE, in *Geography*, a small island near the west coast of Luçon. N. lat. 18° 3'. E. long. 120° 36'.

SOLIMAN, a country of Africa, near the source of the Gambia.—Also, a town of Tunis, the environs of which are inhabited by the descendants of the Moors, driven out of Spain, who preserve their ancient manners and language, and are more honest than other Africans; 20 miles E.S.E. of Tunis.

SOLIMAN, *Bay of*, a bay on the west coast of Africa, in the Strait of Babel-Mandeb. N. lat. 12° 3'.

SOLIMENE, FRANCESCO, called also *L'Abate Ciccio*, in *Biography*, was born at Nocera de Pagani, near Naples, in 1637. He was the son of a painter, Angelo Solimene, who at first educated him in literary pursuits, in which he was exceedingly assiduous, and made considerable progress; whilst at the same time he indulged himself in cultivating an inherent taste for design. By the advice of cardinal Orsini, Francesco was permitted by his father to change the object of his principal pursuit, and, instead of the law, to adopt the pencil, as the ground-work of his future fame. He became the disciple of Francesco Maria, and afterwards of Giacomo del Po; but soon left Naples, to go to Rome, where the freedom and brilliancy of Pietro da Cortona's execution and design attracted his admiration, and fixed his attention. To what he acquired of Cortona, he attempted to add the sweetness of Guido Rheni; and thus framed for himself a style remarkable for its ease and suavity, more than for its grace or truth. A very beautiful production of his is at Hampton Court, of the pool of Bethesda; but his most celebrated works are the sacrifice of S. Paulo Maggiore, and the Last Supper, in the refectory of the conventual at Assisi. Solimene possessed a vivid invention, and consequently a ready pencil; so much so, that his execution is always spirited and masterly, equally adapted to almost all kinds of subjects; and his colouring unites brilliancy and force. He died at Naples in 1747, aged 90.

SOLINGEN, in *Geography*, a town of the duchy of Berg, on the Wipper; 12 miles E.S.E. of Dusseldorf. N. lat. $51^{\circ} 8'$. E. long. $7^{\circ} 2'$.

SOLINUS, CAIUS JULIUS, in *Biography*, a Latin grammarian, but of what particular period is not known, though he is generally referred to the third century. He appears to have resided chiefly at Rome, but is known only as the author of a work, which he first entitled "Collectanea Rerum Memorabilium," afterwards "Polyhistor." This is a collection of the remarkable things in different countries, partly transcribed, without acknowledgment, from Pliny's Natural History; whence the author has been called the ape of Pliny. The work, however, of Solinus contains some things not to be found in Pliny, and it contains likewise an elucidation of some difficulties in the original; and on these accounts it has been deemed worthy of the notice of critics. Salmastius published an edition of it in two vols. folio, in which, however, the original is almost buried in the learning of the commentator. Solinus was author likewise of a poem, entitled "Ponticon," of which only a few verses remain. There have been many editions of the "Polyhistor," which were adapted to the taste of ages fond of wonders. The best modern ones are said to be the octavo of Salmastius, 2 vols. 1689; and Gesner's, printed at Leipzig in 1777.

SOLIO, in *Geography*, a river of Calabria, which runs into the Mediterranean, N. lat. $39^{\circ} 40'$. E. long. $16^{\circ} 6'$.

SOLIPUGA, or SOLIFEGA, in *Natural History*, the name given by the Romans to a small venomous insect of the spider-kind, called by the Greeks *heliocentros*; both words signifying an animal which flings most in the country, and seasons, where the sun is most hot.

Solinus makes this creature peculiar to Sardinia; but this is contrary to all the accounts given us by the ancients. It is common in Africa, and some parts of Europe.

Almost all the hot countries produce this venomous little creature. It lies under the sand, to seize other insects as they go by; and if it can meet with any uncovered part of a man, will bite him, and the wound will prove very painful and envenomed. It is said that the bite is absolutely mortal, but probably this is not true. Solinus writes the word *soli-*

fuga, and so do many others, erroneously deriving the name from its flying from the sun's rays, and burying itself in the sand.

SOLIS, ANTONIO DE, in *Biography*, a celebrated Spanish historian and poet, was born at Alcala de Henares. While he was very young, and a student, he wrote a comedy, which was extremely well received. It was followed by others, as well as by poems on different subjects, by which he raised a very high reputation. He was employed in the secretary of state's office, and the king, Philip IV., made him his own private secretary. In 1661 the queen nominated him historiographer for the Indies; and it was in this quality that he composed his "History of the Conquest of Mexico," a work which placed him among the most approved of the Spanish prose writers, and was greatly applauded both at home and abroad. De Solis took priests' orders when he was in the 57th year of his age, after which he renounced all connection with the theatre, and adopted a regularity of life conformable to his character as a priest. He died in the year 1686. The comedies of De Solis, which were printed collectively in 4to. Madrid, in 1661, are said by critics to be perplexed in their story, and rather romantic than comic; but they have afforded the foundation of many French plays. His poems are said to display more imagination than correct taste. His history is written with spirit and elegance, but there are occasional displays of the bombast and false taste, and frequently are to be met with great deviations from the truth. The object of De Solis is to make a perfect hero of Cortes, and on this account the history terminates with the conquest of Mexico, and does not touch upon subsequent cruelties. It has been translated into the French and English languages.

SOLIS, *Aquæ*, in *Ancient Geography*, a town of Albion, in the 14th route of Antonine's Itinerary, between Isca or Caerleon and Calleva or Silchester. *Aquæ Solis* was unquestionably Bath, which was much frequented by the Romans for its warm and medicinal springs.

SOLIS *Via*. See VIA.

SOLISTEN, in *Geography*, a town of Sweden, in the province of Angermanland; 42 miles N.W. of Hernofand.

SOLITAIRE ISLAND, a small island in the South Pacific ocean; 25 miles S. of Kerguelen's land. S. lat. $49^{\circ} 49'$. E. long. $68^{\circ} 6'$.

SOLITARIÆ GLANDULÆ, in *Anatomy*, those mucous glands of the intestines, which are arranged singly. See INTESTINE.

SOLITARY, SOLITARIUS, something retired, or in private; remote from the company or commerce of others of the same species. See HERMIT.

SOLITARIES, a denomination of the nuns of St. Peter of Alcantara, instituted in 1676, by cardinal Barberini, when abbot of Notre Dame de Faria, in that city.

The design of their institute is to imitate the severe, penitent life of St. Peter of Alcantara; to keep a continual silence; never open their mouths to any body but themselves; employ their time wholly in spiritual exercises; and leave the temporal concerns to a number of maids, who have a particular superior in a separate part of the monastery. They always go bare-footed, without sandals, gird themselves with a thick cord, and wear no linen.

SOLITARY Column, is a column that stands alone in any public place; as the Trajan column.

SOLITARY Worm, *Solum tania*, or *Lumbricus latus*, is a worm sometimes found in the intestines, and which is always the only one of the kind there; as commencing from the pylorus, and extending thence the whole length of the intestines;

intestines; so that there is no room for another. See TÆNIA and WORM.

SOLITARY Island, in *Geography*, an island in the South Pacific ocean, discovered by Mendana in the year 1595. It is low, round, and planted with trees; and the coast is surrounded with rocks. S. lat. $10^{\circ} 4'$. W. long. $178^{\circ} 20'$.

SOLITARY Islands, a cluster of small islands near the east coast of New Holland. S. lat. $30^{\circ} 8'$.

SOLITAUROLIA, in *Antiquity*. See SUOVETAUROLIA.

SOLIVA, in *Botany*, a genus in the *Flora Peruviana*, page 102, dedicated to Salvator Soliva, a Spanish physician and botanist. *De Theis*.

SOLIVE, Fr., among *Carpenters*, a joist, rafter, or piece of wood, either slit or sawed, with which the builders lay their ceilings.

SOLJURA, in *Geography*, a town of Bengal; 28 miles S.S.E. of Curruickpour.

SOLKIEV, or **ZOLKIEV**, a town of Austrian Poland, in Galicia; 10 miles N. of Lemberg.

SOLLAM MOSS. See *SOLWAY Moss*.

SOLLAPOUR, a circar of Hindoostan, in Vissiapour, between the rivers Kistnah and Beema, near their junction.—Also, a town of Hindoostan, and capital of the fore-mentioned circar, on the Kiltnah; 120 miles S.E. of Vissiapour. N. lat. $16^{\circ} 22'$. E. long. $77^{\circ} 10'$.

SOLLECITO, in *Italian Music*. This word has two acceptations: the one implies that a movement is to be performed with a mournful and forrowing expression; the other means carefully, and with accuracy.

SOLLERGUNGE, in *Geography*, a town of Hindoostan, in Oude; 9 miles E. of Lucknow.

SOLLERO, a town of Sweden, in Dalecarlia, on an island in lake Siljan; 48 miles N.W. of Fahlun.

SOLLIES LE PONT, a town of France, in the department of the Var; 13 miles S. of Brignole.

SOLMISATION, or naming the notes in the scale according to the hexachord of Guido. See *MUTATIONS* and *SERRA*.

SOLMISATION of the Greeks. The ancient Greeks had their solmisation in vocal music, as well as the moderns; having for that purpose used four monosyllables, ending with different vowels, for the exercise of the voice in singing; like our *mi, fa, sol, la*. These were, for the first note of each tetrachord, $\tau\acute{\alpha}$; for the second, $\tau\eta$; for the third, $\tau\omega$; and for the fourth, if it did not serve as the first of the adjoining and relative tetrachord, $\tau\epsilon$; but if it began a new tetrachord, it was called by the first name, $\tau\acute{\alpha}$.

The repetition of these monosyllables is a further proof that the *fourth*, in the ancient music, served as a boundary to a system of four sounds, in the same manner as a hexachord did in the Guido scale, and as an octave does for eight sounds in the more modern practice.

SOLMIZARE, in the *Italian Music*. See *SOLFEGGIARE*.

SOLMS, in *Geography*, a principality of Germany, situated in the Wetterau. The counts of Solms are supposed to be descended from the house of Nassau, and are divided into several branches, *viz.* Solms Braunfels, Solms Hohen-Solms, Solms Laubach, Solms Rodenheim, and Solms Lich.

SOLMS, Hohen. See *HOHEN-SOLMS*.

SOLMS, or Burg Solms, a town of Germany, in the principality of Solms Braunfels, having formerly a castle, which gave name to the county; 1 mile E. of Braunfels.

SOLMSBACH, a river of Germany, which runs into the Lahn, 2 miles N.E. of Braunfels.

SOLNAN, a river of France, which joins the Seille at Louhans, in the department of the Saone and Loire.

SOLNIZ, a town of Bohemia, in the circle of Konigingratz; 15 miles E. of Konigingratz.

SOLO, a mountain of Naples, in Lavora; 10 miles S.W. of Ponte Corvo.—Also, a town of Hindoostan, in Mewah; 30 miles N. of Dig.—Also, a town of South America, in the province of Cordova; 100 miles N.W. of Cordova.

SOLO, in *Italian Music*, used substantively, implies a composition for a single instrument, with a quiet and subdued accompaniment, to display the talents of a great performer; as a solo for a violin, German flute, or violoncello. In full pieces, *concertate*, each part is informed when it becomes principal, by the word *solo*; and when subordinate, by *tutti*, which implies the chorus, or full band.

In the concertos of Corelli, Geminiani, and Handel, chiefly composed *à deux cori*, or two orchestras, the principal parts are said to belong to the *concertini*, or solo parts; as *violino primo concertino*, *violino secondo del concertino*, &c.; and the inferior parts, that only play in the full chorus, are called *ripieni*; as *violino primo ripieno*, *violino secondo ripieno*, or *del concerto grosso*, or the great and full concert.

Solos, which used to afford the most exquisite delight to persons of refined taste, when composed and performed by great masters, are now wholly laid aside; and whoever attempts to perform one, is subjected to a penalty instead of a reward; a law instituted at the concert of ancient music, where a composition was never thought complete by the late earl of Sandwich, without a kettle-drum, nor with, unless he beat it himself. And at the Commemoration of Handel, the double drums, double cartels, tromboni, &c. augmented his lordship's pleasure, in proportion to the din and stenterophonic screams of these truly savage instruments; which, in so wide a building as Westminster Abbey, and softened by so powerful a chorus of voices and instruments as were assembled at the Commemoration, had, occasionally, a fine effect; but in a more confined space, the almost incessant use of the tromboni, and perpetual roll of the double drums, annihilate all the pleasing effects of mellifluous tones.

SOLOAYS, in *Geography*, a town of Pennsylvania; 24 miles N. of Easton.

SOLOE, in *Ancient Geography*, a town of the island of Cyprus, built, according to Strabo, by Acamas and Phalerus, both Athenians, but, as Plutarch says, by Demophon, on the banks of the river Clarius. It was situated on an eminence in a barren territory, and called "*Æpira*," denoting *high*, on account of its elevated position. Many ages afterwards, when Solon came to Cyprus and formed a league of friendship with Phylauptus, one of the kings of the island, he advised him to remove the town to a neighbouring plain, on the banks of a river with a port over-against Cilicia. This new city was called *Σολοι*, and in Latin *Solæ* or *Soli*, from the name of Solon. It is now "*Solin*." Another town of the same name in Cilicia, is called by Pliny "*Soloe Cilicij*," by way of distinction from the other. This was afterwards called "*Pompeipolis*."

SOLOE, a cape of Africa, on the Atlantic ocean, which the Periplus of Hannon places at the distance of three days' journey south of the promontory "*Hermeum*." Hannon built on the summit an altar consecrated to Neptune, and it was in process of time adorned with bas-relief works of art, which rendered it the most celebrated place on the coast.

SOLOEIS, a promontory of Libya, at the extremity of mount Atlas, now called Cape Cantin. It is mentioned by Herodotus.

SOLOENTIA, a promontory of interior Libya, between the mouth of the river Nunius and that of the river Maffa, according to Ptolemy.

SOLOFRA, in *Geography*, a town of Naples, in Principato Ultra; 18 miles S. of Benevento.

SOLOGNE, a district of the government of Orleanois, in France, before the revolution, about 60 miles in length, and 18 in breadth, of which Romorantin was the capital.

SOLOK, a town of Lithuania, in the palatinate of Troki, on a lake; 40 miles N.N.E. of Zytomiers.

SOLOMBO, GREAT, a small island in the East Indian sea. S. lat. $5^{\circ} 36'$. E. long. $114^{\circ} 45'$.

SOLOMBO, *Little*, a small island, a little N.E. of Great Solombo.

SOLOMBOL, an island of Russia, in the government of Archangel, situated on the river Dwina; which has a dock-yard for building ships, with a fort and garrison; 5 versts above Archangel.

SOLOMIAC, a town of France, in the department of the Gers; 14 miles S.E. of Lectoure.

SOLOMON, in *Biography*, a king of the Jews, eminently distinguished by his wisdom, wealth, and extent of territory, was the son of David by Bathsheba, formerly the wife of Uriah, and born in the year B.C. 1033. By the influence of Bathsheba, and the recommendation of Nathan, Zadok, and other friends, who thought it necessary to counteract the views and measures of Adonijah, David's eldest son, he was proclaimed the destined successor of his father before his death. When this event took place, B.C. 1015, he ascended the throne of all Israel, not only without opposition, but amidst the acclamations of the people. For his greater security, he ordered Adonijah, and Joab, who was attached to his interest, to be put to death. As soon as he was confirmed in his kingdom, he contracted an alliance with Pharaoh, king of Egypt, and married his daughter, whom he brought to Jerusalem, and for whom he afterwards built a sumptuous palace; receiving for her dowry the city of Gezer, which had been taken from the Canaanites. It was on occasion of this marriage, as some have thought, that he composed the Canticles, as a kind of epithalamium; and the 45th Psalm has been also referred to the same event. About this time he led his troops, and all Israel, to Gibeon, where he offered a thousand burnt-offerings upon the brazen altar. In the following night he is said to have been favoured with a vision, in which God promised to grant him whatsoever he desired: and as the object of his prayer was wisdom for discharging the duties of his high office, his request was fully granted. Upon his return to Jerusalem, he offered a great number of sacrifices on the altar, before the ark of the Lord, and made a great feast for his servants. As an instance of his wisdom, he decided a dispute between two mothers, who claimed the same child. (1 Kings, iii. 16—28.) In token of the acceptableness of his petition, he also obtained, more than he asked for, a gratuitous donation, on the part of God, of riches and honour: which were amply displayed in the magnificence of his court, the amount of his revenues, the multitude of his subjects, the number of his civil and military establishments, and a variety of other circumstances, which rendered him one of the most celebrated monarchs of the East. His reign was peaceful and prosperous. Judah and Israel were united and secure, and his neighbours either formed an alliance with him, or paid him tribute. His dominions extended from the Euphrates to the Nile; and his reputation for wisdom was spread through all nations.

As soon as Hiram, king of Tyre, heard of his accession to the throne of Israel, he deputed ambassadors to congratu-

tulate him; and with the acknowledgment of this message, he requested to be supplied with wood, and able artificers to assist in constructing the temple at Jerusalem, which, in deference to his father's vow, he had undertaken to execute. The completion of this magnificent edifice conferred singular celebrity on the reign of Solomon. It was begun in the 4th year of his reign, and the second after the death of David, B.C. 1012, and 480 years after the Exodus. In the various departments of this great work, he employed no less than 183,600 persons. This wonderful structure was completed in the 11th year of Solomon, or in the short space of seven years; and it was solemnly dedicated on Friday, Oct. 30, B.C. 1000 years. Solomon afterward built two palaces, one for himself and another for his queen; and the construction of the temple and palaces occupied a period of twenty years. He also built the walls of Jerusalem; and he repaired and fortified a great number of cities. The great expence which he thus incurred was defrayed by a commerce which he carried on from Ezion-geber and Elath, on the Red sea, to Ophir; for the situation of which see OPHIR.

Solomon, however, notwithstanding the wisdom which rendered him so famous, had not sufficient fortitude for resisting the temptations that accompanied his prosperity. He was betrayed, in the most culpable and disgraceful manner, into the vices attendant on luxury and sensuality. Besides 700 wives, he had 300 concubines; and in his declining age, though he had erected a temple to Jehovah the true God, and was thus implicitly pledged to preserve the religion of the Jews pure and uncorrupted, their influence caused him to degenerate into the most inexcusable idolatry, setting up as objects of worship, Ashtoreth, goddess of the Sidonians, Moloch, the idol of the Ammonites, and Chemosh, the god of the Moabites, and building for them temples on the mount of Olives, over-against, and east, of Jerusalem. As a just punishment of his culpable conduct, the sovereigns of Edom and Syria were excited against him, and he saw, before his death, the commencement of that revolt which terminated in the division of the kingdom.

Solomon closed his life and reign in the year B.C. 975, having reigned 40 years, at the age of 58. Such is the Scripture account, but Josephus assigns to him a reign of 80 years, and a life of 94 years. He was buried in the city of David, and succeeded by his son Rehoboam, who reigned only over part of the divided kingdom of Israel. Tradition ascribes to him a great number of books; but those only under his name admitted into the canon of Scriptures, are the "Proverbs," "Ecclesiastes," and the "Canticles." See each in its proper place.

SOLOMON'S *Seal*, in *Botany*, a plant called by authors *polygonatum*; which see. See also CONVALLARIA.

SOLOMON'S *Islands*, in *Geography*, a group of islands in the Pacific ocean, discovered by Mendana in 1565; and afterwards by M. Surville, in 1767, who called them *Artacides*, or *Assassins*; they were passed by Lieut. Shortland in 1788, and called by him *New Georgia*. See ARSACIDÆ and GEORGIA.

SOLON, in *Biography*, one of the sages of Greece, and the celebrated law-giver of the Athenians, was born in the seventh century before Christ. He was of a family descended from the ancient kings of Athens, but which, in the revolutions of time, had fallen into indigence, for he passed his early years in travelling on mercantile business. He shewed an early disposition for poetry, which he first exercised on the following occasion. The Athenians, in a war with the Megarensians, had been expelled from the isle of Salamis, and their efforts to recover it were attended with so

much

much loss, that a law passed to make it a capital offence for any one to propose a renewal of the attempt. Solon, feeling mortified at the disgrace attached to this decree, composed an elegy adapted to rouse the spirits of the people, and feigning himself to be under the influence of a temporary insanity, ran into the market-place, mounted the cryer's stool, and pronounced his verses with great vehemence. The crowd gathered round felt a rising ardour; which was farther excited by an harangue of Pisistratus, and they, without hesitation, decreed a war against the Megarensians. Salamis was recovered, and, according to a tradition which has been generally received, by a stratagem of Solon's. He afterwards increased his reputation by advising a war with the people of Cirrha, who had ravaged the sacred territory of Delphi, and contributed to the reduction of their city. Athens at this time was in a very unquiet state, arising as well from the contentions of different political factions, as from the oppressions of the superior classes, who had reduced a great part of the common people to slavery, in consequence of their debts. Solon, in this emergency, was looked up to by the citizens in general as the man who, by his wisdom and virtue, was best qualified to restore public tranquillity, and a large party was desirous of raising him to the sovereignty. This, however, he positively declined; but being chosen archon by acclamation in the year B.C. 594, he set himself to compose the dissensions by moderate measures. At first his plans were not well received, but reflection convinced all parties that his object was good, and they unanimously invested him with the high trust of new-modelling their laws and constitution. He abrogated the sanguinary laws of Draco, excepting such as related to homicide. Democracy being the form of government to which the Athenians were attached, he regarded it as the base of his new constitution, but studied to give it due checks and counterbalances. Hence he divided the citizens into four classes, three of which were formed upon different scales of property: the fourth included those of the lowest order, who were destitute of all property. These were excluded from public offices, but admitted to vote in the general assembly of the people. As this body was in possession of the supreme power, and judged causes in the last resort, the consequence, or at least the safety, of the meanest members of the state was sufficiently secured. To prevent inconsiderate resolutions in the democratic assembly, he instituted a senate of 400, which was to have a prior deliberation upon every proposal to be submitted to the general assembly. Solon revived the ancient Areopagus, and ordained that it should be composed only of those who had passed through the office of archon, the highest magistracy of the state; which conferred on it a splendour that rendered its decrees revered through the whole of Greece. The laws of Solon have been ranged under various heads, but it would not comport with our plan to enter at large into their nature. Their general spirit is mild and equitable. One of them has been the subject of much political discussion: this was, that in any case of civil contest, in which opposite parties take up arms, the citizen who remains neuter shall be punished with exile and confiscation of goods: another regulation, very salutary in its effects, and well adapted to a small state, was, that the Areopagus should have full power to enquire how every citizen supported himself, with the view of inflicting penalties on the idle.

As an apology for any imperfection that might be found in his code, Solon was accustomed to say, "I have given to the Athenians not the best possible laws, but the best they were capable of receiving." The code given by Solon was intended by the author to be in force a century, and then to

be revised and amended, as occasion might seem to demand. After the promulgation of his code, Solon was continually molested by persons who came to him, either for explanation of obscure passages, or with proposals for improvements of which they imagined it capable. To avoid their importunities he resolved to travel; and having obtained leave of absence for ten years, and exacted an oath from the citizens, that nothing should be altered till his return, he sailed to Egypt. He there procured instructions in philosophy from the priests of Heliopolis and Sais, one of whom, it is said, in the pride of Egyptian antiquity, said to him, "Solon, Solon, you Greeks are children, you have not a grey-headed man among you." From Egypt he went to Cyprus, where he suggested to one of the petty princes the erection of a new city, which was called after his name. About this time also he held a conference with Thales, the Milesian, recorded by Plutarch, and it was about this period that he visited the court of Cræsus, king of Lydia.

On his return to Athens, he found the state in great confusion from the contests of different factions. Pisistratus had placed himself at the head of the popular party, and was aiming, through its favour, at the sovereignty. Solon attempted to oppose the current, but in vain: he appeared with his arms in the assembly, and harangued the people, but he had lost his influence, and being wholly unable to rouse the people, he withdrew from Athens never more to return. The place and time of his death have never been accurately ascertained, but it is generally believed that he died at Cyprus, at the age of eighty. The Athenians held his memory in such high reverence, that they erected a statue of brass to his memory in the forum: the opinion of mankind at large has, however, survived the brazen memorial, and he is still regarded as among the greatest benefactors of mankind.

Solon was one of those early Greek philosophers who were distinguished by the appellation of the seven wise men. Philosophy had in that age attained to no systematic cultivation, and the only monuments of the wisdom of most of those ancient sages which have come down to us, are some short moral and prudential maxims, which seem to require for their discovery little depth of penetration or extent of observation. They have, however, been consecrated to perpetual remembrance by the gratitude and admiration of Greece. That the laws of Solon might be open to the inspection of the people, they were inscribed on wooden tablets, turning on axes, and said to have been of different forms, according as the laws which they contained related to private or public affairs. The mode of writing is that which is termed in the Greek language *βασίλειος*, that is, from the right to the left, and then from left to right; the term is taken from the method used in ploughing, which was always done in ancient times by means of oxen. The fragments of Solon's laws have been collected by various writers, but with very great care by Samuel Petit, in a learned work, which is, however, not free from inaccuracies, and conjectures that will not bear the test of criticism. This work was published at Paris, in folio, in the year 1635, under the title of "Leges Atticæ." It was republished by Wesseling, with many improvements, and the additions of his own remarks and those of other critics, in 1742. Diogenes Laërtius has annexed to his life of Solon four epistles, which he ascribes to that philosopher, addressed to Periander, Epimenides, Pisistratus, and Cræsus. Of his sayings or maxims, the following have come down to us. "Laws are like cobwebs, that entangle the weak, but are broken through by the strong:" "He who has learned to obey, will know how to command:" "In every thing you do, consider the object and end:" "In

all things let reason be your guide:" " Diligently contemplate excellent things." Of the poetical talents of Solon, time has left us little opportunity of judging. Thirty-one fragments, collected from Stobæus and other writers, have been printed by Brunk. They are written in various measures, but chiefly in the elegiac. Many of them, in a style resembling that of Theognis, the poet of Megara, are employed in the illustration of useful maxims relative to the conduct of life and formation of manners. The scanty fragments of the Salaminian elegy, to which we have already referred, manifest considerable animation, so that we can easily give credit to what is said of the effect which it produced.

SOLON, in *Geography*, a military township of America, in the state of New York and county of Cortland, bounded N. by Troxton, E. by Chenango county, S. by Cincinnati, and W. by Homer; 10 miles E. of Homer, and 132 miles W. of Albany. It is 12 miles square, and an excellent tract of land. The timber in this township is maple, beech, elm, ash, butternut, bass, together with some pine and hemlock. The soil is principally a warm gravelly loam, well adapted for farming, and the inhabitants are farmers. The population in 1810 consisted of 1270 persons. The roads in this township are in good order; and great numbers of lean cattle are driven from hence every year to Philadelphia, West Chester and Duches counties. —Also, a town of Maine, in the county of Somers, containing 312 inhabitants.

SOLONIUM, in *Ancient Geography*, a town of Italy, in Etruria, according to Dionysius Halicarnassus.

SOLOOKUPA, in *Geography*, a town of Bengal; 15 miles N.N.E. of Nuldingah.

SOLOON, a small island in the East Indian sea; 25 miles from Samar. N. lat. 10° 55'. E. long. 125° 42'.

SOLOR, an island in the East Indian sea, S. of Celebes, about 70 miles in circuit, separated from the E. coast of the island of Flores by a narrow channel, called the Straits of Flores. S. lat. 8° 33'. E. long. 125° 42'.

SOLOS, Σολος, in *Antiquity, an instrument with which the exercise of the quoit was performed, which some will have to be distinguished from the discus, because that was of iron, this of stone; but others, with more reason, report that the difference consisted in this, viz. that the σολος was of a spherical figure, and the discus broad.*

SOLOT, in *Geography*, a small island in the Indian sea, near the coast of Africa. S. lat. 12° 8'.

SOLOTHURN. See **SOLEURE**.

SOLOTKOVA, a town of Russia, in the government of Irkutsk, on the Ilmin; 60 miles S.W. of Orlenga.

SOLOTNICK, in *Commerce*, a weight in Russia, which expresses the fineness both of gold and silver; the pound or other weight being divided into 96 such parts: so that the solotnick is also the $\frac{1}{96}$ th part of a Russian pound weight. According to the mint regulations established in the reign of the emperor Paul, and confirmed by an edict of the emperor Alexander, in 1801, 22 $\frac{3}{4}$ rubles are to contain a Russian pound of fine silver; and they are to be 83 $\frac{1}{2}$ solotnicks (or 10 oz. 8 dwts.) fine; so that each ruble should weigh 320 $\frac{1}{4}$ English grains, and contain 277 $\frac{1}{2}$ grains of fine silver. It was declared that no gold coin should be hereafter struck in Russia, except the imperial and half-imperial, the standard of which was raised to 94 $\frac{1}{2}$ solotnicks, or 188 $\frac{1}{2}$ English grains. Accordingly,

	£	s.	d.	
The imperial is worth	1	12	9 $\frac{1}{2}$	} valued in English gold.
The ducat	0	9	1	
The ruble of 1763	0	3	3	} valued in English silver.
— of 1801	0	3	2 $\frac{1}{2}$	

By an assay lately made on a number of rubles at the London Mint, by order of the Bank of England:—

Rubles of 1763, weight from 14 dwts. 21 grs. to 15 dwts. 20 grs.; average 15 dwts. 8 $\frac{1}{2}$ grs.; fineness 44 dwts. worse than English, that is, 8 oz. 18 dwts.

Rubles of 1801, weight from 13 dwts. 2 grs. to 13 dwts. 12 grs.; average 13 dwts. 7 grs.; fineness 14 dwts. worse than English, that is, 10 oz. 8 dwts. Thus we have the value of the old ruble 3s. 2d. sterling, and of the new, 3s. 2 $\frac{1}{2}$ d.

The Russian weights are as follow, viz. the berquet or berkowitz contains 10 poods; the pood, 40lbs.; the pound, 32 loths; and the loth, 3 solotnicks. The Russian pound weighs 28 loths, Cologne weight, or 6314 troy grains. Hence 500lbs. Russian = 451lbs. avoirdupois. The ordinary computation among merchants is, that 36lbs. avoirdupois = the pood of 40lbs. Russian; and that 63 poods = 1 ton avoirdupois. Kelly's Cambil.

SOLOVETZKOI, in *Geography*, a small island of Russia, in the White sea. N. lat. 64° 55'. E. long. 30° 14'.

SOLRE-LIBRE (*Le Chateau*), a town of France, in the department of the North, and chief place of a canton, in the district of Avesnes; 6 miles N.E. of Avesnes. The place contains 1525, and the canton 7134 inhabitants, on a territory of 212 $\frac{1}{2}$ kilometres, in 23 communes.

SOLSEQUIUM, a word used by some chemical writers as a name for sulphur.

SOLSOGAN BAY, in *Geography*, a bay on the S. coast of the island of Luzon. N. lat. 13° 12'. E. long. 123° 50'.

SOLSONA, or **SALSONA**, a town of Spain, in Catalonia, the see of a bishop, suffragan of Tarragona; 97 miles E. of Saragossa. N. lat. 42° 2'. E. long. 1° 22'.

SOLSTICE, **SOLSTITIUM**, in *Astronomy*, the time when the sun is in one of the solstitial points; that is, when he is at his greatest distance from the equator, which is 23° 28': thus called, because he then appears to stand still, and not to change his place in the degrees of the zodiac, any way: an appearance owing to the obliquity of our sphere, and to which those who live under the equator are strangers.

The solstices are two in each year; the *æstival* or *summer* solstice, and the *hyemal* or *winter* solstice.

The summer solstice is when the sun is in the tropic of Cancer; which is on the 21st of June; when he makes the longest day.

The winter solstice is when he enters the first degree of Capricorn; which is on the 22d of December; when he begins to return towards us, and makes the shortest day.

This is to be understood as in our northern hemisphere; for in the southern, the sun's entrance into Capricorn makes the summer solstice, and that into Cancer the winter solstice.

Mr. Pond, the astronomer royal, from observations made on the summer and winter solstice, deduces the mean obliquity of the ecliptic for January 1, 1813, as 23° 27' 51".50 from the former, and from the latter 23° 27' 47".35.

SOLSTITIAL POINTS, are those points of the ecliptic, by which the sun's ascent above the equator, and his descent below it, are terminated.

The first point, which is in the beginning of the first degree of Cancer, is called the *æstival* or *summer* point; and the latter, which is in the beginning of the first point of Capricorn, the *winter* point. The solstitial points are diametrically opposite to each other.

SOLSTITIAL Colure, is that which passes through the solstitial points. See **COLURE**.

SOLTAU, in *Geography*, a town of Westphalia, in the principality of Luneburg Zelle. The inhabitants are for the most part clothiers; 29 miles N.N.W. of Zell. N. lat. $53^{\circ} 4'$. E. long. $9^{\circ} 55'$.

SOLTCAMP, a town of Holland; 13 miles N.W. of Groningen.

SOLTE, a river of Germany, which runs near Klopensburg in Munster, and joining the Vehnne, takes the name of Soelt, on the borders of Friesland.

SOLTENHAGEN, a town of Hinder Pomerania; 8 miles E. of Zachan.

SOLTKOTT, a town of Westphalia, in the bishopric of Paderborn, famous for its salt-works; 6 miles S.W. of Paderborn.

SOLTZ, a town of Germany, in the county of Henneberg; 4 miles N.W. of Meinungen.

SOLVA, a river of South Wales, in the county of Pembroke, northward of Milford Haven, which forms the port and harbour of the little town of the same name. This small town is situated in a deep valley, pervaded by the above-mentioned river. Most of the houses are of modern erection, and exhibit a neat appearance. They lie principally on the western side of the vale, forming one street in the direction of the river, but scattered without plan or order on the steep acclivity above. Solva is a sea-port, and carries on a small commercial intercourse with the adjacent parts of the coast, chiefly with Milford. Its rapid increase in size, of late years, is an evidence of its prosperity.

SOLVACH BAY, a creek of South Wales, on the N. side of St. Bride's bay; 3 miles E. of St. David's.

SOLUBILITY of Salts, in *Chemistry*, denotes their capacity to unite with, and remain suspended in water; and the different salts possess different degrees of solubility, requiring more or less of this fluid for their solution. See **SALTS**.

SOLUBLE, in *Medicine*, loose, or apt to go to stool. In chemistry it signifies easily dissolvable.

SOLUBLE Tartar. See **TARTAR**, and *Tartrate of Potash*, under **SALTS**.

SOLUBLE Matter of Plants, in *Agriculture*, the soluble parts of them, or the portion of vegetable matter which they contain, and which is capable of solution and of being employed as the food and nourishment of man and animals. The quantities or proportions of this matter, which different plants or vegetable substances possess, is very different. It is consequently not improbable, but that the difference in the nutrient powers of different plants and substances of the vegetable kind may, in a great measure, depend upon this difference in the quantities or relative proportions of the soluble matter which they may contain, but their utility and importance as food do not appear to be wholly dependent upon this circumstance.

SOLUBLE Matter of Soils, the resolvable matter in them, or the quantity and proportion of this sort of matter which they contain in different cases, and which is capable of being converted to use as food for the support and growth of plants as crops. Some soils abound much with materials of this nature, while others are almost wholly deficient of them. This, in some degree, constitutes the difference of fertility in lands, though it is influenced by a great variety of other causes. See **SOIL**.

The rich black soils are, for the most part, the most abundantly provided with this kind of matter, though many others possess it in a considerable proportion.

SOLUE, in *Geography*, a town of Africa, in the country of Barca; 10 miles S.W. of Curen.

SOLVENT, the same with *dissolvent*. See **SOLUTION**.

SOLVENT, *Universal*, in *Alchemy*. See **ALKAHEST**.

SOLVESBORG, in *Geography*. See **SOLFWITZBURG**.

SOLUMBERE, a town of Hindoostan, in the circuit of Oudipour; 35 miles S. of Afawully.

SOLUMBERGA, a town of Italy, in Friuli; 7 miles N. of Aviano.

SOLUS, in *Ancient Geography*, a town of Sicily, according to Pliny; marked in the Itinerary of Antonine as the route from the Lilybæan promontory to the Tyndaris, between Panormus and Thermæ.—Also, a promontory of Libya, on the coast of the Atlantic sea, according to the Periplus of Scylax. A temple, dedicated to Vengeance and Neptune, was erected on the summit of this promontory.

SOLUSAPRA, a town of Sicily, on the route from Tyndaris to the Lilybæan promontory, according to the Itinerary of Antonine.

SOLUTIO CONTINUI, or *Solution of Continuity*, a term used by physicians, &c. to express a disorder common to the solid parts of the body, in which their natural cohesion is separated: as by a wound, or other cause.

If this happen to a simple, similar part of the body, it is called simply *solutio continui*: if to a compound or organical part, it acquires a particular denomination, from the nature of the part, the difference of the cause, or the manner of application; as a *wound, rupture, fracture, puncture, fissure, contusion, ulcer, corrosion, dilaceration, exfoliation, caries*, &c.

SOLUTION, **SOLUTIO**, in *Algebra and Geometry*, is the answering of a question; or resolving any problem proposed. See **RESOLUTION** and **REDUCTION of Equations**.

The solution of the problem of the quadrature of the circle, and that of the duplicature of the cube, by right lines, are held impossible.

SOLUTION of Continuity, in *Surgery*. See **SOLUTIO CONTINUI**.

SOLUTION, in *Physics*, the reduction of a solid or firm body into a fluid state, by means of some menstruum.

Solution is frequently confounded with what we otherwise call *dissolution*, but there is a difference.

SOLUTION, in *Chemistry*, is sometimes used for the analysis, or reduction, of a natural body into its chemical principles.

In this sense, solution is the same with what we otherwise call resolution.

Solution, as the term is commonly used by chemical writers, consists in an union formed by the integrant parts of one body with those of another body of a different nature; and this cannot be effected till the aggregation of one, at least, of the two bodies is broken. And as bodies, whose aggregation is broken, are necessarily in a state of fluidity, or of vapours, an axiom has been formed, *corpora non agunt nisi sint fluida*, i. e. bodies do not act unless they be fluid.

The two bodies which unite in solution, are commonly distinguished by two different names. That body is generally called the *solvent*, which, by its fluidity or acrimony, appears to be active; and the body which, from its want of taste, or from its solidity, appears to be altogether passive, is said to be *dissolved*. E. g. When metal or marble is dissolved in aqua fortis, the solid bodies are considered as being dissolved, and aqua fortis as the solvent. Nevertheless, it must be remembered, that two bodies, which unite together in solution, act reciprocally upon one another, and their union is the effect of their mutual affinity or tendency to each other: and thus the marble and metal act as much upon the nitrous acid as this does upon them.

That a solid may be dissolved in a fluid, it is necessary that the force of affinity between the two should be sufficient to overcome the force of cohesion between the particles of the solid; and hence it is, that heat so much assists solution by lessening the force of cohesion between all particles of matter.

M. Gellert, however, represents as solvents, the bodies which are generally considered as dissolved, and hence, he says, that sand dissolves alkali. If, indeed, we allow the action of the combining bodies to be mutual, it signifies little which we call the solvent, and which the body dissolved; though it seems more clear and accurate to call that body the solvent, whose integrant parts are already separated before the solution, and that the body dissolved, whose integrant parts are only disunited during the act of solution. The solution of bodies may be effected either by the humid, or by the dry way; of the former kind are those solutions, in which the integrant parts of one or both of the two bodies are distributed in an aqueous fluid, *e. g.* of acids; and those solutions, in which one or both bodies are rendered fluid by fire, as in vitrification, and in alloys of metals with each other, are of the latter kind. A perfect solution requires, that each of the integrant parts of one body be united to one of the integrant parts of another: hence, if one of them be transparent, we ought to have, after the mutual solution, a transparent compound, such as occurs in the solutions of calcareous stones and acids, and those of earths by alkalis: whereas the solution of soap in water is incomplete; and the same may be said of glasses that are not perfectly transparent.

As the solution of two bodies can only be effected by the mutual attraction of their parts to each other, these parts, after the solution, are found to adhere together: so that heavy bodies, *e. g.* corrosive sublimate, may be suspended in the thinnest and lightest liquids, *e. g.* spirit of wine, when they are truly dissolved by each other.

In all cases of solution at a common temperature, it generally happens, that the mixture in the act of solution becomes either warmer or colder than the ingredients were before the mixture. This is owing to an evolution or absorption of free caloric, from the mixtures having a less or greater capacity for caloric, than the mean capacity of the two substances taken separately. See CALORIC.

It happens also, in the greater number of cases of solution, that the mixture has a greater specific gravity than the mean gravity of the ingredients, relatively to their respective quantities. Hence they occupy less space than before, which may be seen by putting into a bottle any soluble salt (*e. g.* sulphate of soda), and filling it to the brim with water; after the solution is effected, the liquor will appear to have sunk through a certain interval below the first level, without any loss of the ingredients. See AFFINITY.

When solutions of salts are congealed, the ice often affords very pretty figures; but it is to be observed, that the same salt does not always give the same figures. Thus, the same solution of verdigris, frozen by means of snow and salt, affords a different figure, from what is produced by the natural cold of the air. And the former ice being thawed, and left to freeze in the same phial, did not give the same figures as at first. See Boyle's Works Abridged, p. 168.

SOLUTION, in *Metallurgy*, is distinguished into dry and moist. The dry solution is the blending imperceptibly a small quantity of a metal or mineral, with a very large one of some other body, dry, hard, and not fluid when cold. The moist solution is the distributing a body through the

very minutest parts of an aqueous, or in great part aqueous fluid, in such manner, that both may turn into a fluid, to appearance homogeneous, which goes through all filters, without being detained or separated by them, and the smallest part of which contains in it a proportionable quantity of both the menstruum or dissolvent, and of the dissolved body. The solution of gold in aqua regia, and of silver in aqua fortis, as also that of any of the salts in water, are solutions of this kind. Cramer's Art of Assaying, p. 194.

In the making of the several metallic resolutions, for the necessary processes in chemistry, the operator is subject to great danger in his health, from the noxious vapours. This has been an accident complained of indeed by many, but scarcely attempted to be remedied or obviated by any, in a rational way, till M. Geoffroy, whose experiments subjected him greatly to the mischief, employed his thoughts, for his own sake, as well as that of the world in general, to the effectual prevention of it.

The dissolution of the metals in the corrosive acid spirits are those, which send out the most copious and most dangerous vapours. The exhalation of quicksilver, of antimony, and of lead and copper, are all in themselves greatly hurtful, as well as the fiery vapours of spirit of nitre, sea-salt, or vitriol; and if either of these is singly so, how pernicious must they need be in those cases, where two of them are joined together in such a manner, as that this union sends up infinitely more vapours than would otherwise arise; in this case the utmost care is necessary to prevent the chemist from falling a sacrifice to his zeal for his discoveries.

The common way of avoiding this danger, is by making the solution either abroad in the open air, or in a chimney; but sometimes these cautions cannot be used, and under some circumstances they are ineffectual. This gave occasion to M. Geoffroy to use a method, which he afterwards proposed to the public, of stopping the rise of the vapours entirely, or at least of diminishing them so greatly, that they shall be harmless and unperceived. All that was necessary to this, seemed to him to be the contriving to cover the surface of the fluid with some body, capable of retaining those vapours, yet not capable of disturbing the operation of the menstruum on the metal; and the common expressed oils of fruits, as the oil of olives, almonds, or the like, were found capable of happily performing this effect; and that particularly, as they would easily receive into themselves the acid salts which arise in the conflict. The thing which gave this gentleman the hint of the discovery was, that in the boiling of sugars, honey, or the like substances, when there is any danger of their boiling over the vessel, the pouring in a little oil stops the swelling. In the metallic solutions it has the same effect; and that heightened by this good consequence, that by keeping in the fiery vapours of the acid, it returns them back upon the metal, and by this means does, in effect, add greatly to the power of the menstruum.

This method of using oil has indeed three advantages. 1. The preserving the operator from the injuries of the vapours. 2. The greatly moderating of that violent rarefaction, which is often of ill consequence. And 3. The same quantity of the menstruum, by this means, dissolves more of the metal. The best method of making solutions with this advantage is this: first, wet the surface of the metal to be dissolved with water, or spirit of wine; then pour a little water, or spirit of wine, into the glass in which the solution is to be made, this will prevent the oil from sticking to the surfaces of either; then put the metal into the glass, and pour

pour in the oil upon it; last of all, pour on the menstruum: this, being greatly heavier than the oil, will sink to the bottom and work upon the metal, while the oil perfectly covers the whole surface. There is no need to be exact as to the quantity of the oil, but more or less is to be used, in proportion to the greater or less ebullition which the mixture is expected to make.

The air-bubbles, which arise to the surface with great impetuosity in the making of these solutions, are here seen to break by degrees as they enter the covering of oil, and generally are quite dissipated before they arise to the surface of it. The few of them which retain their figure till they arrive at the surface, there burst and give a slight exhalation; and one may continually see the drops of the menstruum falling back again out of the oil into it, after being deserted by the bubbles of the air which had raised them so far. On the contrary, in the common way of making solutions, the air-bubbles push one another up to the surface, where they form a sort of scum, which continually thickens by their fresh rising and supporting one another, till it often rises over the top of the vessel. These bubbles of air seem to be formed of small particles of air extremely condensed in the pores of the metal, which, when the particles of it are separated for solution, find themselves at liberty to dilate and expand, and arise to the surface in their proper form.

If it be thought necessary, in any solution which raises a more than ordinary quantity of vapours, to prevent the flying off of that small quantity which may escape through the oil, there is nothing more necessary than to pour a little spirit of wine upon the oil; for the acid vapours which pass the oil will then be received in the spirit, and will be dulcified in it, and instead of a disagreeable odour, will yield only a very sweet and safe one. Spirit of wine alone, used instead of oil, and poured gently on the solution, has very great effects; inasmuch, that if used to the solutions in spirit of nitre, which usually send up very noxious and coarse red vapours, they by this means are made to send up only very fine light white ones, and these of a very agreeable smell: the bubbles raised in this case are very small, and usually burst before they arrive at the surface of the spirit. The only objection to this method is, that the spirit of wine soon mixes itself with the menstruum, and there are some cases in which this may be of ill consequence to the process. Mem. Acad. Par. 1719.

SOLUTIVE, LOOSENING, or Laxative. See LAXATIVE.

SOLWAY FRITH, in *Geography*, an arm of the sea, branching off from the Irish sea, and forming a considerable part of the boundary between England and North Britain. Reckoning it to commence at Salterns Point, the S.E. corner of Galloway, its breadth to the nearest land in Cumberland is about eight miles, and its length, inland, to the east, 22 miles. As its outline, however, is rather irregular, it may be considered as comprehending an extent of 80 miles of sea-coast, of which 36 miles are on the Scottish shore and the remainder on the English side. This frith opens to the west, and is rather a troublesome navigation, as it abounds with shoals. The tides here are extremely regular, spring tides rising 20 feet above low water-mark, and ordinary tides about 10 or 12. Numerous rivers pour their waters into the Solway, of which the principal are the Nith, the Annan, the Esk, and the Leven, in Scotland, and the Eden and Wampool, in England. The Solway abounds with fish of various kinds, but particularly with salmon, which are caught in great quantities, and either sold in the neighbourhood, or sent pickled to London and other parts

of England. The modes of taking this valuable fish here are so singular as to deserve a particular detail. They are four in number, first with leisters, a kind of four-pronged fork, with the prongs turned a little to one side, having a shaft from 20 to 24 feet long; these the fishermen run along the sand on the edge, or throw them when they see any fish; in this manner they kill or wound great numbers. Some of the people are very dexterous at this exercise; inasmuch that, according to Mr. Pennant, they will on horseback, at full gallop, throw a leister, and kill at a great distance. 2. By *beaving* and *hauling*, that is, by standing in the current of the tide with small hand-nets. 3. By fixing small pock-nets to stakes in the currents. These nets are made with wide meshes, and the fish that come rapidly down with the stream, instantly run their heads into the meshes, from whence they are unable to disengage themselves. The other method is the common one used in other parts for catching salmon. Sinclair's Statistical Account of Scotland, 8vo. 1796. General Report of Scotland, 8vo. 1814. History and Antiquities of the Counties of Westmoreland and Cumberland, 4to. by Joseph Nicholson, esq. and Richard Burn, LL.D.

SOLWAY MOSS, a tract of land in Cumberland, England, is entitled to some notice in this place on account of the extraordinary effects of its eruption in the year 1771. Mr. Gilpin, in his "Observations on the Mountains and Lakes of Cumberland," &c. two vols. 1781, thus describes the nature of the place and the particulars of the inundation. "Solway Moss is a flat area, about seven miles in circumference. The substance of it is a gross fluid, composed of mud, and the putrid fibres of heath, diluted by internal springs, which arise in every part. The surface is a dry crust, covered with moss and rushes; offering a fair appearance over an unsound bottom, shaking with the least pressure. Cattle, by instinct, know and avoid it. Where rushes grow the bottom is soundest: the adventurous passenger, therefore, who sometimes, in dry seasons, traverses this perilous waste, to save a few miles, picks his cautious way over the rushy tussocks, as they appear before him. If his foot slips, or if he ventures to desert this mark of security, it is possible he may never more be heard of. On the south, Solway Moss is bounded by a cultivated plain, which declines gently through the space of a mile to the river Esk. This plain is lower than the moss, being separated from it by a breast-work formed by digging peat, which makes an irregular though perpendicular line of low black boundary. It was the bursting of the moss through this peat breast-work, over the plain between it and the Esk, that occasioned the dreadful inundation which destroyed so large a district. The more remarkable circumstances relating to this calamitous event were these: On the 13th of November, 1771, in a dark tempestuous night, the inhabitants of the plain were alarmed with a dreadful crash, which they could no way account for: many of them were then in the fields watching their cattle, lest the Esk, which was then rising violently in the storm, should carry them off. In the mean time, the enormous mass of fluid substance, which had burst from the moss, moved slowly on, spreading itself more and more, as it got possession of the plain. Some of the inhabitants, through the terror of the night, could plainly discover it advancing like a moving hill. This was in fact the case; for the gush of mud carried before it through the first two or three hundred yards of its course a part of the breast-work; which, though low, was yet several feet in perpendicular height; but it soon deposited this solid mass, and became a heavy fluid. One house after another it spread round, filled and crushed into ruin, just giving time to the terrified inhabitants to escape. Scarcely

any thing was saved except their lives; nothing of their furniture, few of their cattle. Some people were even surprised in their beds, and had the additional distress of flying naked from the ruin. The morning light explained the cause of this amazing scene of terror, and shewed the calamity in its full extent: and yet, among all the conjectures of that dreadful night, the mischief which really happened had never been supposed. Lands which in the evening would have let for twenty shillings an acre, in the morning were not worth sixpence. On this well-cultivated plain twenty-eight families had their dwellings and little farms; every one of which, except perhaps a few who lived near the skirts of it, had the world totally to begin again. Who could have imagined, that a breast-work, which had stood for ages, should at length give way? or that those subterranean floods which had been bedded in darkness since the memory of man, should have ever burst from their black abode? This dreadful inundation, though the first shock of it was most tremendous, continued still spreading for many weeks, till it covered the whole plain, an area of five hundred acres; and, like molten lead poured into a mould, filled all the hollows of it, lying in some parts thirty or forty feet deep, reducing the whole to one level surface." The plain that was covered with this Stygian torrent, has, however, since been restored to fertility by the exertions of a Yorkshireman named Wilson, whose self-taught genius at once conceived a novel plan, and directed its execution.

This plan was simple and easily executed. Wilson had two large reservoirs formed in the higher grounds, filled them with water, and directed the whole body and force of it, first against a large knoll in front of Netherby house, and afterwards against the masses of accumulated moss, all of which were progressively carried away into the channel of the river Elk. Further particulars may be seen in Gilpin's work, already referred to. Pennant's Tour to Scotland.

The vicinity of Solway Moss became celebrated from the defeat of the Scottish army under the command of Oliver Sinclair, in the reign of Henry VIII. The whole army was either taken or dispersed; and a few fugitives are said to have perished in the moss, into which they had plunged to escape the sword.

SOLYHULL. See **SOLIMULL.**

SOLYMA, in *Ancient Geography*, a name sometimes given to *Jerusalem*; which see.

SOLYMAN, in *Geography*. See **SOLIMAN**.

SOLYMANIA, a district of that portion of the pachalic of Bagdad beyond the Tigris, which comprehends almost the whole of ancient Assyria proper, and is now denominated the Lower Kurdistan; extending from Armenia and the territories of the chief of Julamerick to the district of Mendeli, which is its frontier, towards Kuzistan or Chufistan. Each of the eight districts into which this province is divided has a separate hakem, or governor; but he who resides at Solymania rules over the greatest portion of territory; and as he must, by birth, be a Kurd, he usually assumes the title of pasha of Kurdistan. The town of "Solymania a Shehr e Zour," designated in the retreat of Heraclius by the appellation of Siazuros, is distant 18 leagues E. of Kerkook. It is the residence of Solyman, pasha of Kurdistan, a distinguished warrior, who, in 1810, at the instigation of the Porte, took arms against his master, the pasha of Bagdad, whom he defeated and put to death. Shehr e Zour, having fallen into decay, was some years ago rebuilt by Solyman, pasha of Bagdad, and since that time has assumed his name. It is situated in a delightful country, close to the foot of mount Zagros, and contains about 6000

inhabitants. Not far from Solymania was the city of Holwan, the retreat of Yezdejird, after the battle of Cadesia, and to which the caliphs of Bagdad were accustomed to retire during the heats of summer. It was ruined by Holaku, and has never since recovered its consequence.

SOLYME, in *Ancient Geography*, a town beyond Jordan, in the district of Gaulon. Josephus.

SOLYMI, an ancient and venerable people, mentioned by Homer, and the poet Chœrilus, who spoke Phœnician, cut their hair round, and inhabited the Solymean mountains, near a large lake. These marks, according to Josephus and Tacitus, agree with the Jews, called Solymi, on account of their capital city Jerusalem:—a nation remarkable for the singularity of their laws and of their actions, speaking Phœnician or Hebrew, dwelling in a mountainous country near Jerusalem, situated in the mountains and near the Asphaltite lake. These tokens, according to other learned men, do not designate Jews. Hence some think, that they were Moabites, or Midianites, bordering on the Asphaltite lake, and reckoned among the Arabians, who cut their hair round in a circle. Others think that the Solymean mountains were in Pisidia, near Lycia; and that we must here seek the Solymi of Homer and Chœrilus.

SOMA, in *Commerce*, a corn measure at Bergamo in Italy, which is divided into 8 setari, and contains 4½ bushels, English measure. In the island of Corsica, it is a wine measure; the barile being = 2 fomme = 12 zucchi = 108 pinte = 432 quarti.

SOMA, in *Hindoo Mythology*, is the regent of the moon, being in India a male deity, like the Mouna of the Saxons, and the Lunus among some of the nations who settled in Italy. The Hindoos have however a female moon, as the consort of Soma or Chandra: she is named Chandri, being, in their style of personification, the fakti, or energy of her lord. (See **SAKTI**.) Chandra is a name as often used as Soma, perhaps oftener, and is the common name of the moon in several dialects of India. Chandri is sometimes identified with the goddess Parvati, consort of Siva, and in pictures of that god she is often seen in the form of a crescent ornamenting his head; he is thence named Chandrasekra, or moon-crowned. In the Hindoo theogonies, Soma is stated to be the son of a Rishi named Atri, son of Brahma: and Boodh, or Mercury, is the son of Chandra; Boodh, or Budha, was married to Ila, daughter of the seventh Menu, named Satyavrata. Soma is sometimes said to be the son of Surya, or the sun, having sprung from a ray of that glorious luminary. According to another legend, it was a flash of light from the eye of Atri that impregnated a goddess, who is found to be a personification of the via lactea, or space, who thence bore Soma. So that the Hindoo Soma is both husband, wife, and offspring of the sun. See **ILA**.

Soma is often invoked in the religious ceremonies of the Brahmans, and receives a share in the offerings with which such ceremonies often are accompanied. He is sometimes styled lord of plants, especially of medicinal plants. We may notice here, as connected with some supposed coincidences in Irish and Indian mythology, that *Som* in the former is the deity presiding over plants, the same as in India; for the Sanscrit has merely a grammatical termination: the names are radically alike. (See **SURYA** and **TRIVENI**.) One very mysterious vegetable is peculiarly sacred to the Hindoo Soma: it is called *Somalata*. Soma, like the moon of western mythologists, presides in India over Monday, which day is called Somvar in many dialects. See **ZODIAC**.

The lunar deity of the East is usually portrayed in a car
drawn

drawn by a pied antelope, his head encircled by a silver crescent, and sometimes with a rabbit on his banner. He is commonly seen four-handed, sometimes holding a lotos, a club, a discus, and shell, the usual attributes of Vishnu; though he seems in a greater degree connected with *Siva*, which see. He is also frequently seen with Chandra's emblem, the antelope, in his hand, which emblem is called *Safin*. (See *SASIN*.) A crescent on his forehead, and on the foreheads of his consort and offspring, is also a Sivean family distinction. The idea of a male and female moon has given birth to many poetical fancies and allegories. *Ifa* and *Ifi*, under their names of *Chandra* and *Chandri*, undergo several sexual and other metamorphoses. *Chandra*, or *Deus Lunus*, is the moon when in opposition to the sun; and *Chandri*, or *Dea Luna*, when in conjunction.

In the sol-lunar legends of the Hindoos, the sun is, as we have shewn, sometimes male, sometimes female; and both wife and husband of *Lunus* and *Luna*, under their several names of *Surya*, *Savitri*, *Chandra* and *Chandri*.

Chandri, who concealing herself in *Somagiri*, or the mountain of the moon, was there visited by *Surya*, the sun; from which conjunction arose a numerous family called *Pulinda*. See *ILA* and *ROHINI*.

The Hindoos have a fable that the moon is a vase of nectar, and draw many pleasing figures from this poetical source; hence nectar-beaming is an epithet or name of *Soma*. (See *SASIN*.) Other names or titles of *Soma* are *Himanfu*, *Indu*, *Saganka*, *Safanka*, and *Sushumna*. A similar idea of deriving ambrosia, or inspiration from the moon, is traceable in the poetics of Greece. The Hindoos call this immortal beverage *Umrita*; which see.

Images of *Chandra* are not often seen. He has been noticed among the sculptures in the cavern temple on *Elephanta*, and pictures of him are not rare. He is represented young and handsome; and it is very common for poets, both Hindoo and Mahometan, to compare their mistresses to the full moon; this is perhaps common to almost all nations.

In Hindoo histories and theogonies, mention is made of numerous races, offspring of the sun and moon, and severally called *Suryavanfa* and *Chandra-vanfa*. (See *SURYAVANSA*.) It is common in works of antiquity to see it noticed whether the heroes be of the solar or lunar race, but such distinctions are little regarded in modern times. Austerities are common to Hindoo devotees, in expiation of offences, or as security from evil. (See *TAPAS*.) One species of it is named *Chandrayana*, or the lunar penance. It consists in the sinner or devotee "eating for a whole month no more than thrice eighty mouthfuls of wild grains, as he happen to meet with them, keeping his organs in subjection." The reward, according to *Menu*, is attaining the same abode as the regent of the moon; and it absolves a Brahman from the sin of slaughtering a thousand small animals which have bones, or of boneless animals as many as will fill a cart: and it is also the expiation for killing a *Sudra*, an individual of the fourth or servile class. See *SUDRA*.

SOMADEVA, a name of the Hindoo regent of the moon, who is called also *Chandra*, *Soma*, and by several other names. (See the preceding article.) It is likewise the poetical appellation of a celebrated Indian writer, mention of whom is briefly made under the article *TRIVENI*.

SOMAINPOUR, in *Geography*, a town of Hindooftan, in the circar of *Gohud*; 25 miles S.E. of *Calpy*.

SOMAISSON, a town of Hindooftan, in *Myfore*; 22 miles W. of *Bangalore*.

SOMALATA, in *Botany*, is the Sanscrit name of the *Asclepias acida*, or *cynanchum viminale*, of our systems; a

vegetable highly venerated by the Hindoos. The name means *moon-plant*: it is sacred to *Soma*, or the moon, and is of such profound and mysterious allusion, that none but Brahmans may presume to taste its juice. It is gathered, expressed, and drank, with many superstitious ceremonies; and allusions to it are frequent in the writings of the Hindoos, who are said to consider it as typical of the *umrita* or ambrosia, obtained in so poetical a manner by the gods, and quaffed by them as the beverage of immortality. (See *UMRITA*.) "O thou who quaff the invigorating juice of the fomalata," is an invocation to Brahmans, met with in Sanscrit books; a farther examination of which would perhaps lead to a surmise, if not to a conclusion, that the mysteries connected with this holy vegetable in India are nearly similar to those related of our druids with their mysterious mistletoe. It is noticed under the article *SOMA*, that the Hindoos believe the moon to have great influence on vegetation in general, especially on the fomalata, or moon-plant, of which he is the particular lord; as well as generally of all vegetables.

SOMALPET, in *Geography*, a town of Hindooftan, in *Berar*; 55 miles N.N.E. of *Mahur*.

SOMANAPILLY, a town of Hindooftan, in *Myfore*; 18 miles S. of *Bangalore*.

SOMANOOR, a town of Hindooftan, in *Coimbatore*; 15 miles N.E. of *Coimbatore*.

SOMASQUO, *Fathers of*. See *FATHERS*.

SOMBAR, in *Geography*, a town of Persia, in the province of *Irak*; 114 miles S.W. of *Hamadan*.

SOMBERNON, a town of France, in the department of the *Cote d'Or*, and chief place of a canton, in the district of *Dijon*; 13 miles W. of *Dijon*. The place contains 755, and the canton 7770 inhabitants, on a territory of 235 kilometres, in 28 communes.

SOMBOR, a town of Austrian Poland, in *Galicia*; 6 miles W. of *Halicz*.

SOMBRERA, a small island in the West Indies, about 13 miles N. of *Anguilla*, dependent on *Barbuda*. N. lat. 18° 40'. W. long. 63° 25'.

SOMBRERE CHANNEL, a channel between the *Nicarbar* islands. N. lat. 7° 32' to 7° 50'. E. long. 94°.

SOMBRERETE, a town of Mexico, in the province of *Zacatecas*; 55 miles N. of *Zacatecas*. N. lat. 23° 40'. W. long. 4° 2'.

SOMBRERO, a river of Africa, which runs into the Atlantic, N. lat. 4° 40'. E. long. 5° 52'.—Also, a rock in the sea of *Mindoro*. N. lat. 10° 49'. E. long. 121° 27'.

SOM-CHAN, a town of Chinese Tartary. N. lat. 41° 2'. E. long. 120° 42'.

SOMEBODY KNOWS WHAT, a name given to the extremity of the arm of *Dusky bay*, which captain *Cook* calls "Nobody knows what." This name was given by captain *Vancouver*, who examined and found two inlets, or at least a large branch, divided by a ridge of land through its whole length.

SOMEER, a town of Hindooftan, in the circar of *Gohud*; 10 miles S.E. of *Lahaar*.

SOMEGILL, a river of Wales, which runs into the *Lug* below *Presteign*, in *Radnorshire*.

SOMENSHAR, a town of *Little Bucharja*; 15 miles N.W. of *Hami*.

SOMERA, a town of Sweden, in *Tavastland*; 33 miles S.W. of *Tavasthus*.

SOMERFELT, a town of Prussia, in *Oberland*, W. of *Liebstadt*.

SOMERGEM, or *SOMMERGEN*, a town of France, in the department of the *Scheldt*, and chief place of a canton, in

in the district of Gand or Ghent; 9 miles N.W. of Ghent. The place contains 6221, and the canton 18,800 inhabitants, on a territory of 125 kilometres, in 7 communes.

SOMERS, JOHN, *Lord*, in *Biography*, a distinguished lawyer and statesman, born at Worcester, in 1652, was the son of a respectable attorney of that city. He received his early education at the public school of his native city; and, at a proper age, he was entered a gentleman-commoner of Trinity college, Oxford. He quitted the university without a degree, but he had attained a good taste for polite literature, and being destined by his father for the legal profession, he spent some time as a clerk to sir Francis Winnington, an eminent lawyer, after which he removed to the Middle Temple. When called to the bar, he displayed those talents which ensured his arriving at professional distinction: at the same time, though extremely diligent in his legal studies, he did not abandon his classical pursuits, but translated the history of the life of Alcibiades, and Ovid's Epistle of Ariadne to Theseus.

He was an ardent friend of liberty, and in the latter part of the reign of Charles II. he wrote some political tracts; which, though they appeared without his name, were ascertained to be from his pen.

A piece entitled "The Security of Englishmen's Lives; or the Trust, Power, and Duty of the Grand Juries of England, explained according to the Fundamentals of the English Government," was attributed to him by Mr. Walpole, and is thought to be the same with one alluded to by bishop Burnet, written in consequence of the grand juries return of *ignoramus* to the bill against lord Shaftesbury. He was moreover the reputed author of "A brief History of the Succession of the Crown of England, collected out of the Records," the object of which was to prove the right of parliament to regulate the descent of the crown, with the view of supporting the intended exclusion of the duke of York, on account of his religion. In 1681 he took part in publishing "A just and modest Vindication of the Proceedings of the two last Parliaments," originally written by Algernon Sidney, but new-modelled by him. He was counsel, in 1683, for the sheriffs of London, and for other persons who were prosecuted for a riot in the city at the election of sheriffs. After the accession of James II. he continued the firm opposer of the arbitrary measures of the court, and obtained great credit as one of the counsel for the seven bishops. He most heartily concurred in the event of the revolution, and was one of the confidential advisers of the measure for bringing over the prince of Orange. He sat as representative of his native city in the convention-parliament, and was appointed one of the managers for the house of commons, in the conference held with the lords concerning the word *abdicate*, and his acute and sensible observations on the subject were greatly admired. In 1689 he was knighted, and made solicitor-general, and while he held that high post, delivered a spirited and seasonable speech in favour of the act of convention for recognizing William and Mary, the legality of which had been called in question by a member of the house of commons. In 1692, the office of attorney-general was conferred upon him, and in the following year that of lord-keeper of the great seal. When advanced to the bench, his behaviour was that of an able and upright magistrate, whose love of justice was tempered with singular mildness and condescension. At the same time he was in the highest credit with the sovereign, and he made use of his influence to serve persons of merit. He was a patron to Mr. Addison, and obtained for him an allowance to enable him to make that tour in Italy, of which he has printed an account. In 1695 he was advanced to the lord

chancellorship of England, and was raised to the peerage by the title of lord Somers, baron Evesham. At the same time he obtained certain grants from the crown, a circumstance which has drawn upon him some censure; though, without this addition, his advancement to the peerage would have been a punishment instead of reward, inasmuch as it would have been impossible for him to have maintained his rank in the peerage.

Lord Somers was now regarded as the head of the Whigs, and it was his aim to moderate the heat and jealousy of that party, and conciliate to it both the king and nation; hence it has been averred that he was too compliant in some points to the royal pleasure; which, however, did not prevent his being made a sacrifice when the Tories came into power. His acquiescence in the first partition treaty in 1699, with other ministerial measures, produced great complaints against him in parliament, and an address was moved in the house of commons, praying the king that lord Somers might for ever be removed from his majesty's presence and council. This motion was, however, defeated by a large majority; but the king, soon after, to quiet the discontents, desired him voluntarily to resign his seals. This he refused; and he was accordingly dismissed from his office. In 1701 the house of commons sent up to the lords an impeachment of lord Somers, which, however, was dismissed by the peers, and the prosecution was not resumed. Very shortly after this the king died, and the new reign not being favourable to the principles of lord Somers, he spent his time in literary retirement, and during this period of leisure he was elected president of the Royal Society. He was not, however, inattentive to public concerns, and vigorously opposed the bill brought into parliament by the high church party, to prevent occasional conformity. In 1706 he drew up a plan for effecting an union between England and Scotland, which was so much approved, that queen Anne nominated him one of the managers for carrying that measure into execution. He is also said to have had a considerable share in the bill of regency, by which the Protestant succession to the crown was extended and secured. Upon a change of ministry in 1708, lord Somers was nominated to the post of president of the council, from which he was dismissed in 1710; and though he continued for some time to take an active part in the business of the house of peers, it was not very long before a decline in the state of his health and faculties rendered him unfit for public business. He died in 1716, at the age of 64. The memory of lord Somers is still held in high veneration by the friends of constitutional liberty; to the establishment of which, by means of the revolution and Protestant succession, no individual contributed more than he. His abilities were very considerable, his manners highly ingratiating, and, notwithstanding the opposition which he had occasionally to encounter, few statesmen have passed through life with a purer character. He made a large collection of scarce and curious pamphlets, of which there has been published a selection in four parts, each consisting of four volumes, 4to. His collection of original papers and letters was unfortunately destroyed by a fire, which happened in the chambers of the Hon. Charles Yorke, on the 27th of Jan. 1752. *Biog. Brit.*

SOMERS, in *Geography*, a township of America, in Connecticut, and county of Tolland, containing 1210 inhabitants; 24 miles N.E. of Hartford.—Also, a post-township of New York, on the N. line of West Chester county, 50 miles N. of New York, and 120 from Albany; bounded N. by Dutchess county, E. by North Salem and South Salem, S. by Bedford and New-Castle, and W. by York or Yorktown. Its name, which was formerly Stephentown, was changed in

1808. Here are four grain-mills, five or six saw-mills, two fulling-mills, a paper-mill, and several fine scites still occupied. The soil of this township is generally very good, and adapted to produce a great variety of agricultural products. Here are also a printing establishment, that issues a weekly paper, the post-office, and a small collection of houses. This village is the principal market of lean stock of cattle and sheep, brought hither from distant parts of the country, for the supply of the sales of fattened cattle and sheep to the butchers of New York. The farmers of this country carry on an extensive traffic in this way, and droves are annually and almost constantly arriving from the inland regions, at the distance of 100, 200, and even 300 miles, to replace the consumption. The whole population consists of 1782 persons.—Also, a township of Prebble county, in the state of Ohio, containing 719 inhabitants.

SOMERS *Islands*. See BERMUDAS.

SOMERSDORF, a town of Germany, in the margraviate of Anspach; 5 miles S. of Anspach.

SOMERSET, *Duke of*, in *Biography*, according to Kircher (tom. i. lib. vi. p. 486.) and Printz, in his *Germ. Hist.* Mus. invented in 1649 a new species of violin, with eight strings; which contained all the most excellent secrets of music, and ravished every hearer.

SOMERSET, in *Geography*, a well-cultivated county of New Jersey, in America, on the N. side of the great road from New York to Philadelphia. The soil, especially on Rariton river and its branches, is good, and produces good crops of wheat, of which great quantities are annually exported. It is divided into seven townships, and contains 14,728 inhabitants, including 1968 slaves. The capital of the above county is situated on the W. side of Millstone river, and contains a court-house, gaol, and about 20 houses; 13 miles N. of New Brunswick.

SOMERSET, a county of Maryland, bounded E. by the state of Delaware and Worcester county, and W. by the waters of Chesapeake bay. It contains 17,195 inhabitants, including 6975 slaves. Washington Academy, in this county, was instituted by law in 1779: it was founded and is supported by voluntary subscriptions and donations, and is authorized to receive gifts and legacies, and to hold 2000 acres of land.

SOMERSET, a county of Pennsylvania, bounded N. by Huntingdon, and S. by Alleghany county, in Maryland; it is divided into 15 townships, and contains 11,284 inhabitants.

SOMERSET, a township of the above county, containing 1548 inhabitants; and also a borough, containing 489 inhabitants.

SOMERSET, a county of the state of Maine, containing 12,910 inhabitants.—Also, a township of Washington county, in Pennsylvania, containing 1500 inhabitants.—Also, a township of Windham county, in Vermont, containing 199 inhabitants; 10 or 12 miles N.E. of Bennington.

SOMERSET, or *Sommersett*, a post-town of Bristol county, in Massachusetts, on Taunton river; incorporated in 1790, and containing 1199 inhabitants; 49 miles S.E. of Boston.

SOMERSETSHIRE, one of the maritime counties of England, is situated in the south-western part of the kingdom, and is bounded by the Bristol Channel and Gloucestershire on the north, by Wiltshire on the east, by Devonshire on the south-west, and by Dorsetshire on the south-east. It is of an oblong form, and extends in length from north-east to south-west about 80 miles, and in breadth, in an opposite direction, about 36 miles; the circumference is something more than

200 miles, and the superficial contents about one million of acres.

Ancient Inhabitants, and historical Events.—This district, as well as its borders, is said to have been, in early times, inhabited by the Belgæ, a people of Celtic origin, who migrated hither from Gaul about three centuries prior to the Christian era. They are described as having established colonies, cultivated lands, and instructed such of the natives as chose to associate with them in the arts of industry. Their dominion was greatly extended about 250 years after their first settlement, when Divitiacus, king of the Suevones, brought over from the continent a considerable number of their countrymen. To appease the hostilities which had subsisted between these settlers and the native inhabitants, a treaty was now concluded, and a line or boundary made, to determine their respective territories. This line was perpetuated by a large and deep fosse, called, from the circumstances of its origin, Wanfdike; parts of which are still conspicuous in Wiltshire, &c. It is said to commence near Andover, in Hampshire, and terminate at the Severn sea, at Portishead, in this county; being an extent of about 80 miles. On Marlborough Downs this singular dike appears nearly in its pristine state, being exceedingly deep, and flanked by a lofty mound, or rampart, on its south side. According to this demarcation, the Belgæ occupied a great part of this county: and of their chief cities, Ivelcheiter, Bath, and Winchester, the two former are within its limits. Their contentions with the people, whose possessions they had usurped, lasted till the arrival of the Romans in Britain, when the oppressors, in their turn, became the oppressed. The Cangi, a tribe of those Belgæ who migrated hither under Divitiacus, were nearly annihilated by the Romans, nine years after their invasion. Many remains within this district bear testimony to the characteristic activity of the Romans, in establishing stations, marking out camps, and founding colonies. Besides their cities of Aquæ Solis or Bath, and Icalis or Ilchester, there are many places which, though their ancient names are lost, bear evident marks of a Roman origin, in the foundation of walls, and in various remains that have from time to time been discovered. Their principal road through this county was the Fosse, which extended from Bath, in a south-westerly direction, to Perry-street, on the confines of Devonshire. In a direction nearly parallel to it another road passed from the forest of Exmoor, through Taunton, Bridgewater, and Axbridge, to Portishead; whence there was a trajectus across the Bristol Channel, to the city of Ica Silurum, now Caerleon. A third road, called Via Julia, extended from Bath to Bristol and the Severn; and a fourth communicated from the former station to Portishead. Upwards of twenty-three Roman encampments are enumerated in this county. During the dominion of the Romans, it formed part of the province of Britannia Prima. On the decline of their power, and their evacuation of the country, in the fifth century, it became subject to the Saxons, who incorporated it with their kingdom of Wessex. It is noted as being one of the districts in which the Christian doctrines were propagated at an early period; and, according to ancient authors, king Ina, who began his reign over the West Saxons in 688, built a college at Wells. His successor, Kenulph, converted it into an episcopal see, and built the celebrated abbey of Glastonbury. But in those obscure and barbarous times, the progress of Christianity was necessarily slow and uncertain; for it was not only opposed by superstition, but thwarted by sanguinary wars. The incursions of the Danes kept the country in a state of continual alarm, and threatened its total subjugation. In the reign of Alfred, they desolated almost

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almost every province of Britain, and at length carried their ravages into the counties of Somerset, Wilts, and Hants; which had hitherto remained safe against their encroachments. The young king was constrained to relinquish his throne, and to preserve himself by disguise and concealment. He retired to an obscure part of this county, and lived in the house of a neatherd. During his residence here an incident occurred, which, though trivial in itself, has been thought sufficiently interesting to be recorded in history, and has been given in this work under ALFRED. At the general division of the kingdom into shires and hundreds, this province retained the name of Somersetshire, which the Saxons had given it; and which was probably derived from Somerton, at that time the chief town.

In the Saxon times, this county was subject to certain officary carls, who had authority to try and decide causes, and punish malefactors, within their jurisdiction. The first earl of Somerset was a warlike chief, named Hun, who attended king Egbert in his war with Beornulf, king of Mercia, and was slain in the battle of Ellendune, A.D. 823. At the period of the Norman conquest, when the Saxon nobles were, for the most part, deprived of their honours and estates, this county was bestowed on several chiefs who assisted William in his enterprise, either with troops or money. In this distribution, sir William Mohun obtained by far the greatest share; for, besides the castle of Dunster, he held sixty-one lordships, and had forty-seven knights in his retinue. He likewise received the title of earl of Somerset, which devolved on his descendant, sir Reginald de Mohun. In the sanguinary contests between the houses of York and Lancaster, the inhabitants of Somersetshire were particularly active in behalf of the latter; in consequence of which, it is said, that after Henry VII. was advanced to the throne, he encouraged and patronized the erection of some splendid towers and churches in this county. During the civil war in the reign of Charles I., Somersetshire had its full share of dissention and calamity. Various skirmishes were fought, but no general engagement took place, except one at Lansdown, near Bath, between the parliament's army, under sir William Waller, and the king's forces, under the marquis of Hertford. In this action, out of two thousand horse the marquis lost fifteen hundred, by a regiment of cuirassiers, commanded by sir Arthur Hazlerig, which was so completely armed, that they were called the regiment of lobsters. The marquis, however, drove sir William from his post, and compelled him to retire into Bath. Somersetshire was also the principal theatre of the rebellion of the duke of Monmouth, in 1685.

Surface, Marshes, Soil, &c.—The sea-coast of Somersetshire is very irregular, in some places projecting into lofty and rocky promontories, and in others receding into fine bays, with flat and level shores. From Stert-Point northward the coast is flat, and composed of vast sand-banks repelling the inundation of the sea, which, in ancient times, washed over these shoals, and flowed up into the country, covering with its waters that extensive tract of land, now called Brent-Marsh. The sea, after its general retirement, however, frequently overflowed these parts; and it was found necessary, for the security of the country, to establish a commission of sewers, the members of which were required to examine the sea-banks, ditches, gutters, and sewers, connected with the sea, and order the requisite cleanings and reparations. The first commission of this kind upon record, was in 1304; and similar offices are extended to this day. For fertility of soil and general produce, this county stands eminently high in reputation. The plains are remarkable for their luxuriant herbage, which furnishes not only a suf-

ficiency for home consumption, but also a considerable surplus for other markets. London, Bristol, Salisbury, and other cities and towns of the kingdom, are annually supplied from Somersetshire, with fat oxen, sheep, and hogs, together with cyder, cheese, butter, and many other articles in great abundance. Nor are the hills deficient in arable productions; yet the vicinity of the Bristol Channel, which fills the air with watery vapours unfavourable to the ripening of corn, particularly in the western parts, induces a preference of grazing and dairy husbandry; and, in consequence, vast quantities of grain are purchased from the adjacent counties of Wilts and Dorset, to the amount of at least one hundred thousand quarters annually. The surface of the inland parts is varied by lofty hills, rich level plains, and aspiring woods. The principal hills are the Quantock, between Taunton and the Bristol Channel; Brendon, near Quantock; Poulton, near Bridgewater; Mendip, between Frome and the coast; Broadfield-Down, between Bristol and Wrington; Leigh-Down, in the hundred of Portherry; Dundry, near Bristol; Lansdown, near Bath; White-Down, near Chard; and Black-Down, on the borders of Devonshire. The respective soils of these may be thus stated: Quantock, a thin variable soil, covering a loose shelly rock, interspersed with occasional limestone; Poulton, a strong surface, covering a bed of clay or marl; Mendip, Broadfield, and Leigh-Down, a gravelly loam on a limestone rock; Lansdown, a thin soil on a freestone grit; White-Down, variable; Black-Down, a thin surface of black earth on a bed of sand or gravel. Almost every species of soil (chalk excepted, of which there is only a small portion in the eastern division) may be found in different parts of the county, and of a quality highly fertile and productive.

Forests and Moors.—The ancient forests of Somersetshire were, Selwood, near Frome; Mendip, between Frome and the Bristol Channel; Exmoor, between the port of Watchet and the north-west part of Devonshire; but most of these formerly wooded tracts of country are now deprived of their ancient timber-trees, and inclosed. The principal moors are, King's-Sedgemoor, near Bridgewater; East-Sedgemoor, between Wells and Glastonbury; West-Sedgemoor, between Taunton and Langport; North-moor and Stanmoor, near the isle of Athelney; Common-moor, near Langport; West-moor, Curry and Hay-moor, near North-Curry; King's-moor, between Ilchester and Somerton; Ile-moor, on the river Ivel; Brent-Marsh, on the rivers Brue and Ax; Weston-moor, near Uphill; Banwell and Smeathmoors, near Churchill; Kenn-moor, near Yatton; Nailsea-moor, north of Kenn; Clapton-moor, between Clapton and Wirton. Of these, many have been inclosed, drained, and improved within the course of the last forty years.

Minerals, &c.—This county produces lead, copper, iron, lapis calaminaris, manganese, coal, limestone, paving-stone, tiling-stone, freestone, fullers'-earth, marle, and ochre. The Mendip hills are noted for their mines, particularly of lead and lapis calaminaris. The former seem nearly exhausted, or at least the deep working is so incumbered with water, that little can be done, and in all probability millions in value may remain concealed in the bowels of this mountain. In times past many thousand pounds have been paid to the fee of Wells for the lord's share (that is one-tenth) of the lead dug on the forest within the parish of Wells only.

Coal is abundant in the north-eastern part of the county. In the northern collieries, the strata of coal form an inclination in the plane of about nine inches in the yard. In thickness, it varies from ten inches to upwards of three feet; if

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less than fifteen inches they are seldom worked. Coal is now working generally from seventy to eighty fathom in depth: in a few places deeper; and by the late introduction of machinery to raise it by the steam-engine, a much greater depth of working will be obtained. The coal is of prime quality; pure and durable in burning; firm, large, and of a strong grain; which ensures its conveyance to almost any distance, without injury to its appearance or quality, which cannot be exceeded in any part of the kingdom. Bath is the principal market for sale and place of consumption; to which may be added, the western parts of Wiltshire, and the next adjacent parts of Somersetshire. The quantity raised is from fifteen hundred to two thousand tons weekly: a much greater can be supplied, if an increased demand requires it. Men and boys, to the number of fifteen hundred, are employed in the workings, with wages sufficiently adequate for a comfortable subsistence. The owners of the freehold whence the coal is raised generally receive an eighth of the gross receipt of sale. The average price of coal is five-pence *per* bushel at the pit, nine gallon measure. The collieries in the southern part of this district are on a more limited scale: the strata of coal form an inclination of the plane from eighteen to thirty inches in the yard; in some the plane is annihilated, and the shafts descend in a perpendicular direction. The south-western parts of Wiltshire, the northern district of Dorsetshire, and the east and southern parts of Somersetshire, are the markets for consumption. The quantity raised is from eight hundred to a thousand tons weekly, and capable of extension. Men and boys are employed to the amount of from five to six hundred. Average price three-pence three farthings *per* bushel. At Clapton, a village to the north-west of Leigh-Down, is a coal-work, which possesses the advantage of a land level of forty-four fathoms: about two hundred and forty bushels are landed daily. The best coal is sold at three-pence halfpenny *per* bushel, and the small is shipped at Portishead for Wales, where it is used for burning lime.

Rivers and Canals.—The principal rivers are the Avon, Ax, Brue, Parret, Yow, Cole, Chew, Tone, Frome, Ivel, Ex, and Barl. Of these, four only are navigable, *viz.* the Avon, from Bath to Bristol, 16 miles; the Brue, from the Bristol Channel to Highbridge, two miles; the Parret, from Stert-Point to Langport, about 20 miles; and the Tone, from Taunton to Boroughbridge, eight miles. The chief canals are, the Somersetshire coal canal, which has two branches, one commencing at Paulton, the other at Radstock, and both communicating with that of the Kennet and Avon; the Dorset and Somerset canal, commencing near Nettlebridge, and extending to Frome and thence to the county of Dorset; the Ilchester canal; the Grand Western canal, extending 35 miles from Taunton into Dorsetshire. For a particular account of these, see CANAL, in a former volume of this work.

Climate, &c.—Mr. Billingsley, who in the year 1795 drew up a general view of the agriculture of this county, divides it into three districts, the north-east, the middle, and the south-west. The first comprehending the tract between the ports of Uphill and Kingroad on the west, and the towns of Bath and Frome on the east; the second embracing that portion which is bounded by the Mendip hills on the north, Bridgewater-bay on the west, and the town of Chard on the south; the third occupying the remainder of the county. The north-east district being very irregular in surface, and intermixed with lofty hills and rich fertile plains, the climate is in consequence exceedingly varied. On the western side, including the hundred of Winter-Stoke and Porthury, the soil is, for the most part, a deep and rich mixture of clay

and sand; being originally a deposit by the sea, which, in ancient times, flowed up a considerable way into that part of the country. These moor-lands, as they are called, are subject to frequent inundation; and sometimes in rainy seasons are covered with water for four or five successive months. The middle district of the county, which is the largest, possesses a climate, for the most part, mild and temperate; but on so varied a surface that uniformity of soil cannot be expected.

The south-west district has nearly an equal portion of rough mountainous country, and rich fertile slopes and plains. The climate, particularly of that part which is called the Vale of Taunton-Dean, is peculiarly mild and serene, and the soil highly fertile and productive: and the eye is agreeably relieved by a judicious mixture of arable and pasture lands. There are, however, certain parts north-west of the vale which are mountainous, and subject to that mutability of weather, and moisture of air, generally found on elevated situations.

Civil and Ecclesiastical Divisions.—Somersetshire is divided into forty-three hundreds, and seven liberties. It contains two cities, Bath and Wells, with a part of Bristol, seven boroughs, twenty-two market-towns, one bishopric, three archdeaconries, thirteen deaneries, and four hundred and eighty-two parishes. Of the three archdeaconries, that of Bath contains two deaneries, Wells seven, and Taunton four.

Church History.—Although the inhabitants of this county, as has been observed, embraced Christianity in the seventh century, the ecclesiastical history commences only with the installation of Athelm, a monk of Glastonbury, to the see of Wells, in the reign of Edward the Elder, in the early part of the tenth century. During this reign, pope Formosus, for some unknown reason, excommunicated the whole kingdom, which continued under this sentence seven years, by which several sees were vacant; at length, the degraded monarch called a synod to consider the state of the church, and sent archbishop Plegmund to procure the removal of the interdict, and have new bishops confirmed. Having succeeded in his mission, seven bishops were consecrated in one day, among whom was Athelm, above-mentioned.

Political Economy.—Somersetshire is stated to contain 991,360 acres of land; of which 330,000 are arable, 534,500 pasture, 126,860 of commons, heaths, woods, wastes, roads, &c. The population, according to the return to parliament in the year 1811, amounted to 303,180, of which 141,449 were males, 161,731 females; 23,732 families being stated to be employed in trade and manufactures, and 27,472 families chiefly in agriculture. The number of houses were 54,787. The representatives in parliament are, for the county, two; Bath, two; Bridgewater, two; Ilchester, two; Melborne-Port, two; Minthead, two; Taunton, two; Wells, two: in the whole sixteen members. The county is included in the western circuit; it is in the province of Canterbury; and in the diocese of Bath and Wells.—“The History and Antiquities of the County of Somerset,” by Edm. Rack and the Rev. John Collinson, 3 vols. 4to. 1791. “General View of the Agriculture of the County of Somerset, by John Billingsley, *cfq.*” 8vo. 1798.

SOMERSHAM, a considerable village and parish in the hundred of Hurstington, and county of Huntingdon, England, is situated 6 miles distant from St. Ives, and 68 miles N. from London. It principally consists of one street, about three-quarters of a mile in length from E. to W.; with a second, but much shorter street, crossing the former at right angles. The church is a spacious structure, and consists of a nave, chancel, and aisles, with a substantial embattled tower at the west end. Near the church-yard is a

free school, with a large school-house recently built, 54 feet in length. The rich rectory of Somersham is annexed to the Regius professorship of divinity at Cambridge, and now held by the venerable bishop of Llandaff. Weever says, "William Weller (or Wolfere), parson of Somersham, was master of the rolls, serving Edward III. in the chancery, forty years and more." The bishops of Ely had formerly a palace here: the site is now partly built on; but the adjacent grounds still retain vestiges of their ancient appropriation. The population of Somersham, according to the return to parliament in the year 1811, was 1032; the number of houses 152. A mineral spring was discovered here by the late Dr. Layard, who published a small treatise concerning it in 1759, and whose experiments, with those of Dr. Morris, on its waters, were printed in the fifty-sixth volume of the *Philosophical Transactions*: its virtues are now but little noticed.

About the year 1731, near the road leading from Somersham to Chatteris, in a piece of fen-land belonging to William Thompson, esq. the plough turned up and broke a small urn, containing several Roman coins: and Mr. Thompson and the Rev. Mr. Ramfey, digging near the spot, found another, which contained about sixty coins, mostly copper, and of the late emperors. Camden's *Britannia*, by Gough, vol. ii. *Beauties of England and Wales*, vol. vii. by E. W. Brayley.

SOMERSWORTH, a township of America, in Strafford county, New Hampshire, taken from Dover, and incorporated in 1754, containing 878 inhabitants.

SOMERTON, a small market-town in the hundred of the same name, Somersetshire, England, is situated near the centre of the county, to which it is said to have originally given name, and is 125 miles W.S.W. from London. Somerton is said to have been a Roman citadel: but we have no authentic account of it previous to the Heptarchy, when it appears to have been a town of considerable extent, and strongly fortified. It was at one time a royal residence. Ina, and several other West Saxon kings, held their courts here. In the year 877 it was plundered and laid waste by the Danes, under the conduct of Inguar and Ubba; but was rebuilt, and recovered its importance, both for population and strength. John, king of France, was confined in the castle of Somerton, after his removal from that of Hertford. In the time of Leland this castle was converted into a prison: a part of the town-wall and a round tower still remain, but in a very ruinous condition. The town now consists principally of five streets: it is governed by a bailiff and constables, elected annually by the inhabitants: a weekly market is held on Tuesdays, and four fairs annually. The church is an ancient structure, consisting of a nave, chancel, and side-aisles: at the south end is an octangular embattled tower, 63 feet high. Near the church is an excellent free-school; and a well-endowed alms-house for eight poor women. In the centre of the town is a hall for holding the petty sessions. Adjoining to the town is the tything of Lower Somerton, or Somerton Erleigh; and about a mile eastward is the tything of Hurco: both are included in the parish; which, according to the population return of the year 1811, contained 338 houses, and 1478 inhabitants. Collinson's *History of Somersetshire*, vol. iii.

SOMERVILLE, WILLIAM, in *Biography*, son of Robert Somerville, was born at his father's house at Edilton, in Warwickshire. He was educated at Winchester school, from which he was elected to New college, Oxford. Here he made a good proficiency in classical literature, and cultivated a talent for poetry. His first piece, as far as is known to the public, was an ode to the duke of Marlbo-

rough, on his dismissal from his posts in 1710. He was strongly attached to the Whig party; and when Addison purchased an estate in Warwickshire, Somerville addressed a poem to him, which includes the following couplet, alluding to the papers in the several volumes of the *Spectator*, to which are annexed the letters C, L, I, O.

"When panting virtue her last efforts made
You brought your CLIO to the Virgin's aid."

Mr. Somerville inherited a considerable paternal estate, on which he chiefly lived, acting as a magistrate, and pursuing with vigour the amusements of a sportsman, varied by the studies of a man of letters. He was courteous and hospitable, but too much addicted to conviviality, and careless of economy. His mode of living threw him into embarrassments, which so preyed on his mind, that for the sake of relief, he fell into habits that shortened his life. He died in 1742, which Shentone thus notices to a friend and correspondent.

"Our old friend Somerville is dead! I did not imagine I could have been so sorry as I find myself on this occasion. I can excuse all his foibles, impute them to age and to distresses of circumstances: the last of these considerations wrings my very soul to think on. For a man of high spirit, conscientious of having, at least in one production, generally pleased the world, to be plagued and threatened by wretches that are low in every sense; to be forced to drink himself into pains of body, in order to get rid of pains of the mind, is a misery."

Somerville is chiefly known, as a poet, by his piece entitled "The Chase," which is written in blank verse, and which maintains a high rank in the didactic and descriptive class. It has the advantage of being composed by one who was perfectly acquainted with the sports which are its subject, and who entered into them with all the enthusiasm which they are calculated to inspire; hence his pictures, in exactness and animation, greatly excel the draughts of the same kind, attempted by poets by profession. Its language is free and nervous, and its versification generally denotes a nice and practised ear. He has another piece connected with this in subject; it is entitled "Field Sports," though it only describes that of hawking. His "Hobbinol, or Rural Games," is a kind of mock heroic, in which the burlesque is managed with tolerable success. Of his other pieces, serious and comic, there are few that can be said to add to his fame; but they make a part of the collection of British Poets.

SOMEVOIRE, in *Geography*, a town of France, in the department of the Upper Marne; 15 miles S. of St. Dizier.

SOMGHETIA, a province in the principality of Georgia, W. of Teflis.

SOMINO, a town of Africa, in Bambarra, on the Niger. N. lat. 13° 11'. W. long. 4° 48'.

SOMLYO, a town of Hungary; 29 miles S. of Zatmar.

SOMMA, a town of Naples, in Lavora, near which are annually produced between 7000 and 8000 pounds of silk of the best quality; 10 miles E. of Naples.—Also, a town of Italy, in the department of the Olona; 24 miles N.W. of Milan.—Also, a town of the Popedom, in Umbria; 4 miles S. of Spoleto.

SOMMARIVA del Bosco, a town of France, in the department of the Tanaro; 5 miles S.E. of Carmagnola.

SOMMARIVA di Perao, a town of France, in the department of the Tanaro; 7 miles E.S.E. of Carmagnola.

SOMMARNAS,

SOMMARNAS, a town of Sweden, in the province of Tavastland; 35 miles S.S.W. of Tavasthus.

SOMME, a river of France, which rises near Fontomme, in the department of the Aisne, passes by or near to St. Quentin, Ham, Peronne, Bray, Corbie, Amiens, Pequigny, Abbeville, St. Valery, &c. and runs into the English Channel, about 5 miles W.N.W. of St. Valery.

SOMME, one of the eleven departments of the northern region of France, composed of Amienois, Ponthieu, Vimeux, and Santerre, between Calais and Oise, in N. lat. $49^{\circ} 45'$, and bounded on the N. by the department of the Straits of Calais, on the E. by the department of the Aisne, on the S. by the department of the Oise, and on the W. by that of the Lower Seine, and the English Channel. Its territorial extent is $6512\frac{1}{2}$ kilometres, or in French leagues 34 in length, and 16 in breadth. It is divided into 5 circles or districts, 41 cantons, and 848 communes. The circles are Abbeville, containing 114,060 inhabitants; Doullans, with 45,627; Peronne, with 91,470; Montdidier, with 62,668; and Amiens, with 151,209 inhabitants: the whole population being 465,034. According to M. Haffenratz, it is divided into 5 circles and 72 cantons; and its population consists of 381,760 persons. The capital is Amiens. In the year 11 of the French era, the amount of its contributions was 5,650,664 fr., and its expences and charges 395,027 fr. 69 cents. This department is fertile in grain, fruits, hemp, flax, and pastures, and has some forests.

SOMMEIL, in *French Music*, an invocation to sleep; an old French movement of the lullaby kind, much in favour during the time of Merfennus; and continued in use, according to Blainville, in the reign of Louis XIV., when operas were first attempted at Paris.

SOMMERDA, or **SOMMERN**, in *Geography*, a town of Saxony, in the territory of Erfurt; 11 miles N.N.E. of Erfurt.

SOMMERDYCK, or **SOMMELSDYKE**, or *Zomerdyck*, a town of Holland, and chief town of the island of Overflakke; 20 miles W.S.W. of Dort.

SOMMEREUX, a town of France, in the department of the Oise; 3 miles N.E. of Grandvilliers.

SOMMERFELD, a town of the New Mark of Brandenburg; 15 miles S. of Crossen.

SOMMERGEM. See **SOMERGEM**.

SOMMERO, a small island in the gulf of Finland. N. lat. $60^{\circ} 8'$. E. long. $24^{\circ} 36'$.

SOMMERSET. See **SOMERSET**.

SOMMERSHAUSEN, a town of Germany, in the lordship of Speckfeld, on the Maine; 4 miles S. of Wurzburg. N. lat. $49^{\circ} 45'$. E. long. $10^{\circ} 3'$.

SOMMIER, Fr. the wind-cheft, or found-board of an organ. See **SOUND-BOARD**.

SOMMIERES, in *Geography*, a town of France, and principal place of a district, in the department of the Gard; 12 miles S.W. of Nismes. N. lat. $43^{\circ} 47'$. E. long. $4^{\circ} 11'$.

SOMMITE, in *Mineralogy*, *Nepbeline*, Haüy, a mineral which occurs in small crystals and crystalline grains, in the lava on the sides of mount Somma, a part of Vesuvius. The form of the crystal is a six-sided prism; the colour is greyish or greenish-white: the angles are sufficiently hard to scratch glass. The crystals are lamellar on the faces of the prism, but conchoidal, with a vitreous lustre, in the direction perpendicular to the axis of the crystal. It melts with difficulty before the blow-pipe, into a transparent homogeneous glass.

Its specific gravity is 3.3. According to Vauquelin, sommite contains

Silex	-	-	-	-	46
Alumine	-	-	-	-	49
Lime	-	-	-	-	2
Oxyd of iron	-	-	-	-	1

This mineral covers the cavities of lava, and is accompanied with hornblende, mica, and vesuvian.

SOMNAMBULISM, in *Medicine*, from *somnus*, *sleep*, and *ambulo*, *I walk*; sometimes also called *noctambulism*, or *night-walking*; is a singular condition of the body, in which a person performs many voluntary actions, implying a certain degree of perception of the presence of external objects, but without consciousness while the actions are performed, and without recollection of them when the consciousness returns.

This affection, as its name implies, is commonly considered as an imperfect degree of sleep; as it most frequently occurs after sleep, and seems to be but a more active exertion of volition than that which takes place in imperfect sleep, when we move, and even talk, and support ourselves in different postures. "There are many cases," says Mr. Stewart, "in which sleep seems to be partial; that is, when the mind loses its influence over some powers, and retains it over others. In the case of the *somnambuli*, it retains its power over the limbs, but it possesses no influence over its own thoughts, and scarcely any over the body; excepting those particular members of it which are employed in walking." (See his *Elements of the Philosophy of the Human Mind*, chap. 5, part i. § 5.) The subject is very obscure, in consequence perhaps of the rarity of these cases, which have not been sufficiently examined, since the physiology of the mind was rationally investigated. Dr. Cleghorn, however, in his excellent thesis "*De Somno*" (Edin. 1783), pointed out some circumstances which distinguish this condition from sleep; and Dr. Darwin has more recently considered it as belonging to *reverie*, and not to sleep, or as approximating rather to epilepsy or catalepsy, than to mere dreaming, or night-mare, to which it has also been referred.

Some of the most remarkable and best authenticated cases of somnambulism on record seem to favour this view of the subject. The older authors, Horst, Sennert, Schenck, Henry ab Heers, Willis, and many others, have related cases of somnambulism, in which various actions were unconsciously performed, such as opening doors and windows, crossing bridges, even walking on the tops of houses, and up precipitous paths, climbing to take a rook's nest, and various other feats. It is said, that if any sensation is excited sufficiently strong to awaken the somnambuli, they experience great surprize and terror, sometimes fall in syncope, and have no recollection of what has passed during the paroxysm. The essence of the disease, however, as Dr. Darwin observes, seems to "consist in the inaptitude of the mind to attend to external stimuli;" and they are not easily awakened. One of the cases most fully investigated, and reported to the Physical Society of Lausanne, while it exhibits the peculiarities of the malady, seems to prove that a slight and brief impression is actually made upon the senses, which excites afterwards so powerful a conception, or is so strongly fixed in the imagination, that the volition continues to direct the actions as accurately as if the impressions on the senses were repeated; which is also the character of *reverie*.

The somnambulist, in the case alluded to, was a lad thirteen years and a half old, of a good constitution, but of great sensibility and irritability, and very variable spirits.

His proceedings were watched by a committee of gentlemen, who reported the result to the society above-mentioned. His sleep was at all times unquiet, but the walking did not occur every night; sometimes several weeks past, during which he was free from it. The paroxysm commonly began about three or four o'clock in the morning, and the longest of them lasted from three to four hours. It was preceded by motions in every part of the body, with starting and palpitations; he then uttered broken words, and sometimes sat up in his bed, and afterwards lay down again. Then he began to pronounce words more distinctly, rose abruptly, and acted according to the instigation of his imagination. When he came out of the paroxysm, he did not recollect any of the actions he had been performing. It was dangerous, however, to awaken him during the continuance of it, especially if it were done suddenly; for he sometimes fell into convulsions. "Having risen one night with the intention of going to eat grapes, he left the house, passed through the town, and went to a vineyard, where he expected good cheer. He was followed by several persons, who kept at some distance from him, one of whom fired a pistol, the noise of which instantly awakened him, and he fell down without sense. He was carried home and brought to himself, when he recollected very well having been awakened in the vineyard, but nothing more, except the fright at being found in the vineyard alone, which had made him swoon."

The following statements shew how the impressions of external objects on the senses mingled with his reverie, as in the case of ordinary dreams. See DREAMS.

"Once he was observed dressing himself in perfect darkness. His clothes were on a large table, mixed with those of some other persons; he immediately perceived this, and complained of it much: at last a small light was brought, and then he dressed himself with sufficient precision. While his imagination was employed on various subjects, he heard a clock strike, which repeated at every stroke the note of the cuckoo. 'There are cuckoos here,' said he; and, upon being desired, he imitated the song of that bird immediately." Again, the reporters say, "If he is teased, or gently pinched, he is always sensible of it (unless he is at the time strongly impressed with some other thing), and wishes to strike the offender: however, he never attacks the person who has done the ill, but an ideal being, whom his imagination presents to him, and whom he pursues through the chamber without running against the furniture, nor can the persons whom he meets in his way divert him from the pursuit."

Other facts, which the reporters record, impressed them with a belief that the sleep-walker was capable of receiving certain impressions through the medium of the senses, when they accorded with the images which his imagination was occupied in forming; but that this faculty was predominant, and only admitted those perceptions which, on the principles of association, mingled with the reverie. They inferred, too, that he was obliged to open his eyes, in order to recognize objects; but that the impression, once made, although rapidly, was vivid enough to supersede the necessity of opening them again; that is, the same objects appeared to be afterwards represented by the conceptions of his imagination, with as much force and precision, as if he actually saw them. In the effort to open his eyes, however, when he wished to see an object, he could scarcely raise them a line or two, by drawing up his brows; and the iris appeared fixed, and the eye dim. He made this effort whenever any thing was presented to him, and he was told of it, always half

opening his eyes with great difficulty, and then shutting them after he had taken what was offered.

"Having engaged him to write a theme," the committee observe, "we saw him light a candle, take pen, ink, and paper from the drawer of his table, and begin to write, while his master dictated. As he was writing, we put a thick paper before his eyes, notwithstanding which he continued to write, and to form his letters very distinctly; shewing signs, however, that something incommoded him, which apparently proceeded from the obstruction which the paper gave to his respiration, being held too near his nose."

"An experiment was made by changing the place of the ink-standish, while Devaud was writing. He had a light beside him, and had certified himself of the place where his inkholder was standing by means of sight. From that time he continued to take ink with precision, without being obliged to open his eyes again: but the ink-standish being removed, his hand returned as usual to the place where he thought it was. It must be observed, that the motion of his hand was rapid, till it reached the height of the standish, and then he moved it slowly, till the pen gently touched the table, as he was seeking for the ink. He then perceived that a trick had been put upon him, and complained of it: he went in search of his ink-standish, and put it in its place."

This experiment, they affirm, was several times repeated, and was always attended with the same circumstances. And they put the following questions respecting the inferences to be drawn from it. "Does not what we have here stated prove, that the standish, the paper, the table, &c. are painted on his imagination in as lively a manner as if he really saw them; since he sought the real standish in the place where his imagination told him it ought to have been? Does it not prove that the same lively imagination is the cause of the most singular actions of this sleep-walker? And, lastly, does it not prove that a mere glance of his eye is sufficient to make his impressions as lively as durable?"

These conclusions appear to be legitimate; and the facts seem to shew how much more completely this condition of the somnambulist is allied to *reverie*, than to *sleep*, though commonly commencing from the latter. From the slightest degree of absence, or *brown study*, as it is popularly called, in which the conceptions of the imagination, upon subjects that interest the individual, are so vivid as to exclude for a time the perceptions excited by surrounding objects, up to this complete somnambulism, various degrees of the abstraction from external impressions may be traced. Most persons, perhaps, have been sensible, at times, when any subject of severe study, or any great gratification, anxiety, or distress strongly occupied their minds, how great the disposition to this abstraction has been. If engaged in reading, they have pursued every line with the eye, turned over leaf after leaf, and at length awoke from the reverie which had occupied the imagination, and found that not the smallest impression had been made on the mind by the pages which the eye had perused, and the hand had turned over. If walking in a crowded street, they have probably proceeded some way under the influence of reverie, moving the limbs as usual, directing the walking-tick, and performing other unconscious but voluntary acts, winding safely among the passing people, avoiding the posts and other obstacles, but so exclusively occupied by the conceptions of the mind, as to be totally insensible of all these actions of their own volition, and of the objects which they have passed, and which necessarily impress their senses so as to regulate those acts. From this state of the faculties in reverie, which we have so often experienced in our-

elves, and observed in others, as to suppose that the truth of the foregoing statement will be readily admitted, that condition of them which constitutes somnambulism seems to differ principally in two circumstances, *viz.* in commencing commonly in a disturbed sleep, and in requiring a stronger impression upon the senses to break the chain of mental conception; so that the lighter impressions only mingle with and modify the conceptions, according to the principle of association. The following singular example of the somnambulistic reverie is well authenticated, and is related of an amiable and distinguished poet. We quote it from the life of that writer in Anderfon's edition of the poets, vol. xi.

“Dr. Blacklock, one day, harassed by the censures of the populace, whereby not only his reputation, but his very subsistence was endangered, and fatigued with mental exertion, fell asleep after dinner. Some hours after, he was visited by a friend, answered his salutation, rose, and went with him into the dining-room, where some of his companions were met. He joined with two of them in a concert, singing, as usual, with taste and elegance, without missing a note, or forgetting a word. He then went to supper, and drank a glass or two of wine. His friends, however, observed him to be a little absent and inattentive: by and by he began to speak to himself, but in so slow and confused a manner, as to be unintelligible. At last, being more forcibly roused, he awoke with a certain start, unconscious of all that had happened; as till then he had continued fast asleep.”

Those who wish to investigate this curious subject farther, may consult the old writers mentioned in the beginning of this article; also Hoffmann's *Dissertatio de Somnambulismo*, in the third volume of the supplement to his works; the French *Encyclopédie*, article *Somnambulisme*; Darwin's *Zoonomia*, vol. i. sect. xix; Cleghorn de *Somno*, &c.

SOMNER, WILLIAM, in *Biography*, an able antiquary, was born at Canterbury in the year 1606. He received a good common education, after which he was taken as clerk by his father, who was register of the court of Canterbury. He was afterwards promoted by archbishop Laud to an office in the ecclesiastical court of that diocese, which naturally engaged him in the study of national antiquities. To pursue this to advantage, he applied with great diligence to the Saxon tongue, and having made himself master of that language, he drew up copious notes, and a glossary, to sir Roger Twissden's publication of the laws of Henry I. The antiquities of his own country engaged his particular attention, and he composed “A Treatise of the Roman Posts and Forts in Kent,” left by himself in MS. but which was printed at Oxford in 1693; and “A Treatise on Gavelkind,” completed in 1647, and published in 1660. He also wrote “A Discourse of *Portus Iccius*,” which was afterwards translated into Latin by bishop Gibson, and published with some other tracts. Having studied all the kindred dialects to the Saxon, he wrote observations on some old German words, collected by Lipsius, which were published by Meric Casaubon, and he drew up the Glossary annexed to the ten writers of English history, published by Twissden. This glossary being a key to replete and antiquated words, improved whatever of this nature had been done before. It is, indeed, a work of that extent as may serve as a key to all other historians, and to all records: “nevertheless,” says the writer of the life in the *Biographia Britannica*, “it might be greatly improved from our author's subsequent collections, which remain in the archives of Canterbury; from Junius's “*Etymologicum Anglicanum*,” and from Dr. Wilkin's Glossary, at the end of his edition of the Saxon laws. Mr.

Somner assisted Dugdale in compiling the “*Monasticon*.” In 1659 he published a Saxon dictionary, in folio, which has been styled the true and lasting monument of his praise; a work of incredible labour and himself, and of singular benefit to the world. The previous assistance of the like kind which came into Mr. Somner's hands were, 1. *Ælfrie's Glossary*, transcribed by Fr. Junius, from a very ancient copy in the library of sir Peter Paul Rubens, of Brussels; 2. The two ancient glossaries in the Cotton library; 3. Nowell's Saxon Vocabulary; 4. Joceline's Collections. From these and some other Saxon books then extant, Mr. Somner made immense collections, in two large volumes, for the compiling his dictionary. When it was finished, he sent it to Oxford, where it was printed, and it came out in the year already mentioned. During the composition of this dictionary, he was chiefly supported by the salary settled on the Saxon lecture, founded by sir Henry Spelman. Somner being a zealous royalist, he was arrested and imprisoned on account of the Kentish petition for a free parliament, in the same year that his dictionary was published; but was liberated on the restoration, and promoted to the mastership of St. John's hospital, in Canterbury. He died in 1669, and his books and manuscripts were purchased by the dean and chapter of Canterbury, and deposited in the cathedral library. *Biog. Brit.*

SOMNIFEROUS. See SOPORIFEROUS.

SOMNOLENTUM COMA. See COMA.

SOMNUS, in *Mythology*. See SLEEP.

SOMORROSTROW, in *Geography*, a town of Spain, in the province of Biscay, situated on a bay of the Atlantic; which, according to the opinion of baron Dillon, has all the appearance of being alluvial. Some of the workmen, as he says, assured him that they have often found broken pieces of pick-axes, mattocks, and other instruments, in places that had been worked centuries ago, and are now replete with new ore. Hence he infers that the mine increases. The ore is said to form an uninterrupted stratum, whose thickness varies from three to ten feet, and is covered with a coat of whitish calcareous rock, from two to six feet thick. Every one is at liberty to dig at pleasure, and transport it by land or water, without being subject to duties or any formalities. It is generally allowed, that no iron in Europe is so easy to fuse, or so soft, as that of Somorrostrow. When the ore is first taken out of this mine, it has the colour of bull's blood; and when wetted becomes purple. Great quantities are carried away by water to the neighbouring provinces, where they fuse it by itself, or mix it with ore of their own, which generally yields a harder iron. According to appearance, a quintal of ore will produce about 35 lbs. of good iron, and the residue about 30 lbs. of slag and dead earth. 13 miles N.W. of Bilbao. N. lat. 43° 19'. W. long. 3° 7'.

SOMOSIERRA, a town of Spain, in New Castile; 8 miles N. of Buytrago.

SOMOVNIA, a town of European Turkey, in Bulgaria; 10 miles W. of Nicopoli.

SOMPIL, a town of Thibet; 45 miles E.S.E. of Pa.

SOMPUINS, or SOMPY, a town of France, in the department of the Marne, and chief place of a canton, in the district of Vitry-sur-Marne; 18 miles N.W. of Menchould. The place contains 645, and the canton 4745 inhabitants, on a territory of 382½ kilometres, in 16 communes.

SOMSDORF, a town of Saxony, in the circle of Erzgebirg; 10 miles S. of Freyberg.

SON, a relative term, applied to a male child, considered in the relation he bears to his parents. See CHILD and PARENT.

The children of the king of England are called *sons* and *daughters of England*. The eldest son is born duke of Cornwall, and created prince of Wales. The younger sons are called *cadets*.

The king of France's children were anciently called *filz* and *filles de France*, *sons* and *daughters of France*; and the grand-children, *petits filz* and *petits filles de France*. At a later period, the daughters were called *mesdames*; and the grand-daughters *mesdemoiselles de France*.

SON, *Natural*. See BASTARD.

SON, *Adoptive*. See ADOPTIVE.

SON of God, is a term used in various senses in the holy scripture, as, 1. For Jesus Christ, or the Saviour of mankind; who is thus called, as some say, with respect to the manner of his generation, as being begotten of the Father.

This seems to have been the opinion of Dr. Clark, in his "Scripture Doctrine of the Trinity." Generation, says he, when applied to God, is but a figurative word, signifying only, in general, immediate derivation of being and life from God himself: and "only begotten" signifies being so derived from the Father, in a singular and inconceivable manner, as thereby to be distinguished from all other beings. Among men, a son does not, properly speaking, derive his being from his father; father, in this sense, signifying merely an instrumental, not an efficient, cause: but God, when he is styled father, must necessarily be understood to be (*αἰτία*) a true and proper cause, really and efficiently giving life. This consideration, he says, clearly removes the argument usually drawn from the equality between a father and son upon earth. It is observable, as our author proceeds, that St. John, in that passage, where he not only speaks of the Word before his incarnation, but carries his account of him farther back than any other place in the whole New Testament, gives not the least hint of the metaphysical manner how he derived his being from the Father; does not say, he was created, or emitted, or begotten, or was an emanation from him, but only that he *was*, that he *was in the beginning*, that he *was with God*, and that he was (*Θεός*) partaker of divine power and glory with and from the Father, not only before he was *made flesh* or *became man*, but also *before the world was*. As the scripture, says Dr. Clark, has no where distinctly declared in what particular metaphysical manner the Son derives his being from the Father, men ought not to presume to be able to define.

Some suppose, that this title of "son of God" belongs to Christ, on account of his possessing the same divine nature with the Father. Accordingly bishop Pearson says, the communication of the divine essence by the Father was the true and proper generation, by which he hath begotten a son. A son is nothing but another produced by his father, of the same nature with him. But God the Father hath communicated to the Word the same divine essence, by which he is God; and he says, the Father hath the essence or attributes of himself, and the Son by communication from the Father. But Dr. Waterland denies any literal generation of the son at all; for he supposes his being in the Father, before he was generated, to be the first and most proper filiation or generation; which he allows to be a mere co-existence with the Father, and not any derivation from him.

Whilst the Athanasians believed the Father and Son to be of the same substance, *i. e.* of the same *generical* substance, as two men are of the same substance; and the Pseudo-Athanasians believed them to be of the same identical *numerical* substance; the Arians, who believed the divine substance of the Father to be *ἀγέννητος*, unbegotten, and *ἀρχαῖος*, without beginning, concluded, that it was different

from the substance of the Son, who was begotten, and had a beginning. Moreover, as they believed the divine substance of the Father to be indivisible and un-compounded, they could not believe the Son to be generated in or from it, in any *literal* sense, either as being compounded with it, or divided from it; and, therefore, they concluded, that the generation of the Son was *figurative*, and was not a participation of substance, but a creation; as the word creation is frequently used in scripture with regard to mankind. They believed that Christ was the only begotten Son of God, because he only was created by the immediate act and power of God himself, and that all other beings, the Holy Ghost not excepted, were created by Christ; in which they agreed with Origen and Eusebius; and, therefore, they called him a creature, but not like other creatures; but they believed that he was generated or created before all ages.

Sonship, says Dr. Lardner, in his "Letter on the Logos," (Works, vol. x. vol. xi.) is a term of nearness, dearness, and affection; and Jesus is the Son of God, 1st, upon account of his miraculous conception and birth (Luke, i. 31—35); 2^{dly}, upon account of the especial commission given him by the Father, and the extraordinary qualifications bestowed upon him, in order to his fulfilling it (Matt. iii. 16. Mark, i. 10. Luke, iii. 21, 22. John, i. 32—34. iii. 34. If. xi. 1—3. xlii. 1—4. lxi. 1—3. and Matt. xii. 17. Luke, iv. 18, 19.); 3^{dly}, on account of his resurrection from the dead on the third day, to die no more (Rom. i. 3, 4. Heb. i. 6.); 4^{thly}, on account of his exaltation to God's right hand, and being invested with authority and dominion over all flesh, and constituted judge of the world, by whom God will pass sentence upon all mankind (John, iii. 35. v. 21, 22. Heb. i. 1, 2. iii. 5, 6.); 5^{thly}, on account of the pouring out of abundance of spiritual gifts, though in different degrees, upon his apostles, and those who believed in him after his resurrection (John, i. 32—34. Matt. iii. 1. Mark, i. 8. Luke, iii. 16. John, vii. 37—39. Acts, xi. 15, 16. i. 5. ii. 1—36. Gal. iv. 6. Eph. ix. 8—13.) Upon all these accounts, and not only upon account of his miraculous conception and birth, is Jesus "the Son of God." Our author suggests, that the passages which he has cited manifestly shew, that it is in respect to his humanity, and the dignity conferred upon it, that he has the title of the Son of God. This learned author rejects the opinion of those who understand by the "Son of God," an intelligent being or emanation, begotten by the Father, or proceeding from him, in an ineffable manner, from all eternity, and of the same essence or substance with the Father; and also of others, who understand by this appellation a mighty spirit, or angel, begotten or formed by the will of the Father, in time, before the creation of the world, and of a different substance from the Father; which son of God, as they say, became incarnate, that is, united himself, either to the human nature, consisting of soul and body, or to an human body, so as to supply the place of a human soul. These senses of the title, as he says, are not to be found in any of the books of the New Testament. The Jews, according to Whitby upon Rom. ix. 5. had no notion that their Messiah should be any thing more than mere man. See also Jortin's Discourses concerning the Christian Religion, p. 17. In the gospels, as Dr. Lardner observes, this title of the "Son of God" is given to our Lord, by many who took him to be a man specially favoured by God. (Matt. xvi. 16. and the parallel places. John, vi. 69. John, i. 34. iii. 35, 36. John, i. 49. xi. 27. Matt. xiv. 33. Luke, iv. 41.) Our blessed Lord likewise often takes it to himself, either directly or indirectly. (John, iii. 17, 18, v. 25. ix. 35—37. x. 36. xi. 4.) In the Jewish style,

style, and the language of scripture, all good men, and all people who are in a covenant relation to God, are his sons, and as such entitled to many privileges and blessings; but Jesus, as the Messiah, is "the Son of God," by way of eminence and distinction, and has in all things the pre-eminence. Accordingly, the Christ, or the Messiah, and the "Son of God," are equivalent in the New Testament. (Matt. xvi. 16. John, vi. 69. Mark, viii. 19. Luke, ix. 20.) And that, in the language of the Jews, the titles of Messiah and Son of God are the same, may be seen in Matt. xxvi. 63. and Luke, xxii. 66. 70. John, i. 34—49.

2. Several creatures are also called "sons of God," not as being so by nature and generation, but on divers other accounts. Thus, the angels are called sons of God by Job, in respect to their creation, adoption, &c. And great men are called sons of God in the Psalms, as being his lieutenants, or the depositories of his authority. Good men, and particularly the eminently pious, as we have clearly shewn, are also called sons of God, in various places of the sacred writings.

SON of Man, is frequently used, in scripture, to signify man; as expressing not only the nature of man, but his frailty.

The expression is very usual among the Hebrews and Chaldeans: Daniel, Ezekiel, and Jesus Christ, are particularly thus called; the first once, and the two latter frequently.

Some think, that the "son of man," when used by our Saviour, denotes his high dignity, or a man of distinction and eminence, and is equivalent to Messiah, or the Christ; and he thus intends to signify, that he is the great person spoken of by the prophets, who was to come for the benefit of mankind. (See Dan. vii. 13, 14. Matt. xxvi. 63, 64. Mark, xiv. 61, 62.) Against this sense Dr. Lardner has suggested some exceptions: and he observes, that man, and son of man, with the Hebrews, often denote a man of low condition. (Ps. xlix. 1, 2. Pl. cxliv. 3.) Our Lord, therefore, by this phrase or character, might represent that humbling of himself, which is spoken of by the apostle in the second chapter to the Philippians, and is the same with what is said in 11. liii. 3. "he is despised, and rejected of men," or is one of the lowest and meanest of men. Our Lord adopts this character in speaking of himself, in order to undeceive the Jews, and correct their false opinion concerning the kingdom of the Messiah; and to intimate, that he was not to arrive at glory, and the full possession of his kingdom, but through sufferings and humiliations. If son of man, then, be equivalent to Messiah, it is not used, as our author conceives, to denote his dignity, as the first and greatest of men, but rather to signify his humble form and low condition, in which he then lived; and is expressive of the scorn and contempt which were cast upon him, and in which he acquiesced.

Dr. Lardner further intimates, agreeably to his own opinion of the person of Christ, that he frequently makes use of this expression to denote his real humanity, and also that he was not made and created as Adam, but was a man born even of a woman. He adds also, that our Lord might assume this character as a modest way of speaking. Eminent and distinguished persons, who have many occasions to speak of themselves, especially if it be to their advantage, decline the too frequent use of the phrases *I* and *me*, and choose to speak in the third person, as of another, distinct from themselves. Works, vol. x.

Sometimes the phrase son of man is also used for the wicked and reprobate; in contradistinction to those called sons of God.

SON, Fr., a musical sound.

SON *Fondamental*. See FUNDAMENTAL.

SON *Fix*, Fr., a fixed and unalterable sound. To acquire such a sound, we must be certain that it will be the same at all times, and in all places. To be sure of this, it is not sufficient to have a pipe of a certain length or diameter in the fixed place; for though the pipe may always remain in the same state, the weight of the air will not always remain the same: the sound will become more grave or acute, as the air becomes more dense or rarefied. For the same reason, the sound of the same pipe will change with the column of the atmosphere, in proportion as this pipe shall be carried high or low, in the mountains or in the villages.

Secondly, this same pipe, of whatever materials it is made, will be subject to the variations which heat and cold occasion in all bodies. A pipe or string, if of metal, will lengthen or shorten; and its tone will be higher or lower, in proportion. If the pipe be of wood, it will swell or shrink, expand or contract; and from these causes combined, arises the difficulty of acquiring a fixed tone, and almost the impossibility of being sure of the same sound in two places at the same time, or twice in the same place.

SON, or *Sun-Plant*, the *crotalaria juncea* of Linnæus, in *Botany*, is cultivated in every part of Hindoostan with great assiduity, and applied to various uses. The seeds reduced to powder, and mixed with oil, form a kind of unguent, which the black ladies apply to their hair, in order to make it grow. The bark of this plant furnishes all kinds of rope, packing-cloths, nets, &c.; and from these, when old, most of the paper in that country is prepared. For this purpose they cut them into small pieces, macerate them in water for about five days, wash them in water, and then throw them into a vessel of water strongly impregnated with a lixivium composed of six parts of sedgi mutti, which is an earth containing a large portion of fossile alkali, and supposed to be the natron of the ancients, and seven parts of quick-lime. Here they remain eight or ten days, when they are again washed, broken into fibres by a stamping lever, and then exposed to the sun, and again steeped in a fresh lixivium, as before. When they have undergone three operations of this kind, they are fit for making coarse brown paper; and after seven or eight operations, they are prepared for making paper of a tolerable whiteness. For a farther account of the process, see Phil. Trans. vol. lxiv. p. 101, where it is minutely described and illustrated by figures.

SONABARYA, in *Geography*, a town of Bengal; 38 miles N.E. of Calcutta.

SONAH, a town of Hindoostan, in Bengal; 8 miles S.S.E. of Ghidore.

SONAN SUNDI, a town of Congo; 10 miles W. of Cundi.

SONAPURRA, a town of Hindoostan, in Bengal; 26 miles E.S.E. of Kishenagur.

SONATA, Ital. from *sonare*, to sound, or play on an instrument. Its use at present, in *Music*, is confined to solos for a single instrument: as Corelli's solos for the violin, Martini's solos for the German flute; and trios, or compositions in three parts, for two violins and a baste, &c. But which, in the body of these works, are all called *sonatas*.

In the last and 17th century, the Italians had distinct sonatas of two kinds: as *sonate da chiesa*, sonatas for the church; and *sonate da camera*, sonatas for the chamber, or private concerts, of a lighter kind. The first and third set of Corelli's sonatas are of the former kind, and the second and fourth of the latter. To the first and third set of Co-

relli's sonatas for the church, there are two bases, one for the base viol, or viol da gamba, and the other for the organ, arch lute or liarp, figured for thorough-bass.

In vocal music, *si suona* is written over the symphony or ritornelli, interstitial passages played by an instrument, either as an echo to the voice part, or to give the singer time to breathe. *Si canta*, "it is sung," to distinguish the vocal from the instrumental passages of songs written on one staff.

SONAUT, or SUNAT *Rupee*, in *Commerce*. See RUPEE.

SONAWRY, in *Geography*, a town of Hindoostan, in Oude; 20 miles S. of Bahraitch.

SONAX, a town of France, in the department of Mont Blanc; 4 miles N.N.E. of Chambéry.

SONCHUS, in *Botany*, *συνχος* of Dioscorides, supposed by some etymologists to be corrupted from *συνχος*, *hollow*, or *empty*, in allusion to its hollow stem. This seems scarcely satisfactory, and yet we meet with nothing else worth mentioning. In English it is named Sow-thistle, because swine are particularly fond of the plant.—Linn. Gen. 400. Schreb. 527. Willd. Sp. Pl. v. 3. 1509. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 4. 436. Sm. Fl. Brit. 815. Prodr. Fl. Græc. Sibth. v. 2. 124. Pursh 501. Juss. 169. Tourn. t. 268. Lamarek Illustr. t. 649. Gærtn. t. 158.—Class and order, *Syngenesia Polygamia-equalis*. Nat. Ord. *Compositæ semistrobiliferae*, Linn. *Cichoraceæ*, Juss.

Gen. Ch. *Common Calyx* imbricated, bellying, of numerous, linear, unequal scales. *Cor.* compound, imbricated, uniform; florets all perfect, numerous, equal, of one petal, ligulate, linear, abrupt, with five teeth. *Stam.* Filaments five, capillary, very short; anthers united into a cylindrical tube. *Pist.* Germen nearly ovate; style thread-shaped, the length of the filament; stigmas two, reflexed. *Peric.* none, except the calyx, closing into the form of a depressed globe, with a conical point. *Seeds* solitary, rather oblong; down capillary, sessile. *Recept.* naked.

Eff. Ch. Receptacle naked. Calyx imbricated, swelling at the base. Seed-down simple, sessile.

Having detailed at length the species of SCORZONERA, (see that article,) a genus which has been, in several instances, confounded with the present, we find it necessary to give a reformed view of *Sonchus*, following Willdenow in the distribution of the species.

1. *S. maritimus*. Sea Sow-thistle. Linn. Sp. Pl. 1116. Willd. n. 1. Ait. n. 1. Prodr. Fl. Græc. n. 1889. Allion. Pedem. v. 223. t. 16. f. 2. Cavan. Ic. v. 1. 38. t. 51.—Flower-stalks mostly solitary, terminal, naked. Leaves clasping the stem, lanceolate, undivided, with sharp reflexed teeth.—Native of maritime situations in the south of Europe, and north of Africa. Dr. Sibthorp met with it in Crete. Miller cultivated this plant in 1748, but it is hardly to be seen in any garden at present, either here or on the continent. The root is perennial. Stem herbaceous, about two feet high, slender, round, scarcely divided. Leaves near a foot long, narrow, smooth, glaucous, with a double set of small, sharp, recurved teeth; their base tapering, entire, clasping the stem at the bottom. Flowers sometimes two or three, on long, slightly bracteated, stalks, yellow, above an inch in diameter, with a smooth calyx.

2. *S. crassifolius*. Thick-leaved Sow-thistle. Willd. n. 2. Pourret MSS.—"Flower-stalks somewhat umbellate, scaly. Leaves lanceolate, with spreading pointed teeth; their base rounded, clasping the stem."—Native of Spain. Root perennial. This plant is intermediate between *S. maritimus* and *arvensis*, but most akin to the for-

mer. Stem simple, erect. Leaves thick and glaucous, unequally toothed; the teeth lanceolate, spreading at right angles. Flowers the size of the preceding, terminal, somewhat umbellate, with very short, solitary, single-flowered, axillary stalks, from the uppermost leaves. Each stalk is scaly, and shorter than its calyx.

3. *S. uliginosus*. Bog Sow-thistle. "Marschall von Bieberstein." Fischer MSS.—Flower-stalks somewhat umbellate, naked, much longer than the calyx. Leaves elliptic-oblong, with copious, spreading, pointed teeth; their base rounded, clasping the stem.—Native of mount Caucasus. Communicated under the above name, by Dr. Fischer of Moscow. This seems nearly related to the last. The stem is erect, stout, somewhat branched, three feet or more in height, round, smooth, leafy. Leaves four or five inches long, and above an inch broad, acute, smooth, veiny, rather thick or coriaceous, slightly glaucous, bordered with very numerous spinous teeth, projecting at right angles. Flowers resembling the last, four or five together in terminal umbels, whose stalks are quite naked and smooth, as well as the calyx.

4. *S. quercifolius*. Oak-leaved Shrubby Sow-thistle. Desfont. Atlant. v. 2. 225. t. 213. Willd. n. 3.—Flower-stalks somewhat corymbose, alternate, slightly scaly. Calyx-scales loosely imbricated. Leaves oblong, sinuated, toothed, somewhat three-pointed. Stem shrubby. On hills near Casia in Barbary. Stem from one to two feet high, branched, thick and fleshy. Leaves scattered, from four to eight inches long, very smooth and glaucous, rather succulent, evergreen, pinnatifid, with sharp lobes, directed forward rather than backward, their base tapering down into a short dilated footstalk. Flowers terminal, yellow, about an inch and a half broad, four or five together in a lax corymbose panicle. Scales of the calyx ovate, smooth, not close-pressed. Desfontaines.

5. *S. fruticosus*. Great Shrubby Sow-thistle. Linn. Suppl. 346. Willd. n. 4. Ait. n. 2. Jacq. Coll. v. 1. 83. Ic. Rar. t. 161. L'Herit. Stirp. t. 81.—Flower-stalks somewhat umbellate, bracteated. Calyx-scales loosely imbricated. Leaves oblong, sinuated, slightly runcinated, toothed. Stem shrubby.—Gathered by Mr. Masson on rocks in the islands of Teneriffe and Madeira, from whence it has found its way into the more curious greenhouses of this and other countries. The habit is much like the last, with a thick fleshy stem. The chief difference seems to consist in the more umbellate inflorescence, accompanied by leafy bractæas. The calyx is squarrose in a dried state only. Flowers like the common Dandelion in size and colour.

6. *S. acidus*. Sour Sow-thistle. Willd. n. 5.—"Flower-stalks branched, naked. Calyx-scales spreading. Leaves pinnatifid, with oblong-lanceolate, pointed, entire segments. Stem shrubby."—Gathered in Morocco by Mr. Schousboe. Leaves half a foot long, flaked, smooth. Flower-stalks very much branched, somewhat forked, and partly umbellate. Flowers the size of *S. arvensis*. Willdenow.

7. *S. pinnatus*. Wing-leaved Sow-thistle. Ait. ed. 1. v. 3. 116. ed. 2. n. 3. Willd. n. 6.—"Flower-stalks naked. Calyx smooth. Leaves pinnate; leaflets linear-lanceolate, slightly toothed. Stem shrubby."—Gathered by Mr. Masson in Madeira, from whence it was introduced into the greenhouse at Kew, in 1777, but it seems never to have flowered, and is now perhaps lost.

8. *S. radicans*. Long-rooted Sow-thistle. Ait. ed. 1. v. 3. 116. ed. 2. n. 4. Willd. n. 7.—"Flower-stalks naked, smooth like the calyx. Stem shrubby, almost naked. Radical leaves lyrate, smooth on both sides, with triangular

triangular ovate lobes. Brought by Mr. Masson from the Canary islands, in 1780. It flowers in the greenhouse in July. *Aiton*.

9. *S. taraxacifolius*. Dandelion-leaved Sow-thistle. Willd. n. 8.—Flower-stalks scaly, panicle. Leaves runcinate, with callous teeth; tapering at the base.—Native of Guinea. *Stem* as thick as a goose-quill, spongy. *Leaves* rather crowded, smooth, like Dandelion, but the tips of their teeth are white; the upper ones lanceolate, scarcely divided, though minutely toothed; the uppermost of all linear and entire. *Common flower-stalk* six inches, or more, in length, furnished with a few leaves, and dividing into a panicle at the top; *partial ones* very short, scaly, crowded at the terminations of the panicle. *Calyx* like the Garden Lettuce. *Willdenow*.

10. *S. palustris*. Tall Marsh Sow-thistle. Linn. Sp. Pl. 1116. Willd. n. 9. Fl. Brit. n. 2. Engl. Bot. t. 935. Curt. Lond. fasc. 5. t. 59. Fl. Dan. t. 606. (*S. laevior austriacus quintus altissimus*; Cluf. Hist. v. 2. 147. *S. arborecens* alter; Ger. Em. 294.)—Flower-stalks somewhat umbellate, bristly like the calyx. Leaves runcinate; arrow-shaped at the base; rough in the margin.—In low marshes, especially about the mouths of great rivers, in Holland, France, England, &c. as well as in Greece, flowering in July and August. It occurs in several places bordering on the Thames, below London, as well as in the isle of Ely. The *root* is perennial, fleshy, branched, but not creeping. *Stems* herbaceous, from six to eight feet high, leafy, angular, hollow, but little branched. *Leaves* runcinate, acute, smooth, finely toothed, not rounded, but acutely arrow-shaped, at the base. *Panicle* umbellate or cymose, of several yellow flowers, whose *calyx*, as well as the *flower-stalks*, is rough with dense, black, glandular hairs. Haller confounded this with the following, but Curtis has well distinguished them.

11. *S. arvensis*. Corn Sow-thistle. Linn. Sp. Pl. 1116. Willd. n. 10; (excluding the reference to Fl. Dan.) Fl. Brit. n. 3. Engl. Bot. t. 674. Curt. Lond. fasc. 4. t. 53. Pursh n. 1. (*S. arborecens*; Ger. Em. 294. *Hieracium majus*; Fuchf. Hist. 319.)—Flower-stalks somewhat umbellate, bristly like the calyx. Leaves runcinate, finely toothed; heart-shaped at the base. *Root* creeping.—In fields and about hedges, on a clay soil, in the middle or southern parts of Europe, as well as in Pennsylvania; frequent in England, especially towards the sea, flowering in August. The *root* is fleshy and milky, running deep into the ground, and difficult of extirpation. *Stem* but three or four feet high, nearly simple. *Leaves* rounded at the base. *Flowers* larger than in the last, and of a fuller golden hue, externally reddish; the tubes of their florets hairy. Dr. Sibthorp thought this the *σολυχος*; *ἄνερος* of Dioscorides.

12. *S. agrestis*. West Indian Sow-thistle. Swartz. Prodr. 110. Ind. Occ. 1289. Willd. n. 11. (*S. laevis*; Sloane Jam. v. 1. 255.)—Flower-stalks downy, many-flowered. *Calyx* smooth. *Stem* striated. *Leaves* sessile, deeply ferrated or cut.—Native of cultivated ground in the West Indies, along with *S. oleraceus*. *Root* annual. *Stem* two or three feet high, leafy, round, deeply striated, downy. *Lower leaves* scarcely divided. *Flowers* terminal and axillary, yellowish-white. *Calyx* elongated, sometimes slightly pubescent, but little tumid at the base, in which this species differs from the *oleraceus*, as well as in the remarkable shortness of its *florets*, which have not the appearance of being ligulate, but tubular. *Seeds* long, striated. *Swartz*.

13. *S. lacerus*. Jagged-leaved Sow-thistle. Willd.

n. 12.—“Flower-stalks umbellate, rather downy. *Calyx* smooth. *Leaves* pinnatifid, toothed; auricled and heart-shaped at the base.”—Native country unknown. *Root* annual. *Stem* two feet high, or more. *Leaves* with lanceolate, angular-toothed segments; their base dilated, clasping the stem, and coarsely toothed. *Flower-stalks* branched. *Flowers* the size of *S. oleraceus*. *Willdenow*. We have a mutilated specimen gathered by Thunberg at the Cape of Good Hope, which, as far as any judgment can be formed of it, answers to the above description; but it is very like the prickly varieties of the common *oleraceus*.

14. *S. angustifolius*. Narrow-leaved Sow-thistle. Defont. Atlant. v. 2. 225. Willd. n. 13.—“Leaves pinnate, glaucous, smooth; leaflets distant, linear, finely toothed. *Stem* scarcely any.”—Gathered near Casfa, in Barbary, by Desfontaines. *Root* perennial, long, spindle-shaped. *Stem* very short, or none. *Leaves* from four to eight inches long; their teeth withered and whitish. *Flower-stalks* slightly scaly, bearing one or more yellow flowers, the size of *S. arvensis*. *Calyx* smooth, ovate. *Desfont*.

15. *S. umbellifer*. Umbelliferous Cape Sow-thistle. Thunb. Prodr. 139. Willd. n. 14.—“Flower-stalks hispid, somewhat umbellate. *Leaves* oblong-heart-shaped, ferrated.”—Native of the Cape of Good Hope.

16. *S. glaber*. Smooth Cape Sow-thistle. Thunb. Prodr. 139. Willd. n. 15.—“Flower-stalks umbellate, smooth like the calyx. *Leaves* heart-shaped, runcinate.”—Native of the same country.

17. *S. gorænsis*. Scaly Goree Sow-thistle. Lamarck Dict. v. 3. 397. Willd. n. 16.—“Flower-stalks lateral, short, clothed with membranous scales. *Leaves* lyrate, with little spinous teeth.”—Native of the island of Goree, on the west coast of Africa. Sparrmann sent seeds to the Paris garden. The *root* is annual. *Stem* a foot high, round, smooth, with lax branches. *Leaves* distant, clasping the stem, scarcely more than two inches long, and one broad, smooth, green, somewhat runcinate. *Flowers* yellow, almost sessile along the branches. *Calyx* nearly cylindrical. *Flower-stalks* smooth, their scales with white membranous edges. *Lamarck*.

18. *S. oleraceus*. Common Sow-thistle. Linn. Sp. Pl. 1116. Willd. n. 17. Fl. Brit. n. 4. Engl. Bot. t. 843. Curt. Lond. fasc. 2. t. 58. (*S. laevis*; Ger. Em. 292. Camer. Epit. 279. Matth. Valgr. v. 1. 452.)

β. *S. oleraceus*; Fl. Dan. t. 682. (*S. laevis latifolius*; Ger. Em. 292.)

γ. *S. asperior*; Ger. Em. 291.

δ. *S. asper*; *ibid*.

ε. *S. subrotundo folio nostras*; Pluk. Phyt. t. 61. f. 5.

ζ. *S. aphyllocaulis, angusto et oblongo folio, nostras*; Pluk. Phyt. t. 62. f. 4. See also t. 61. f. 5.

Flower-stalks downy, imperfectly umbellate. *Calyx* smooth. *Leaves* runcinate, toothed.—A common weed in cultivated land throughout Europe, as well as in other parts of the world to which Europeans have had access, flowering in summer and autumn. The *root* is annual, spindle-shaped. *Herbage* smooth, brittle, milky, very various with respect to luxuriance, and the quantity of teeth, lobes, or prickles about the edges of its *leaves*; their segments, however, are almost always acute and runcinate. *Flower-stalks* axillary and terminal, rather cymose than umbellate, clothed when young with soft, white, dense, cobweb-like, deciduous down. *Corolla* lemon-coloured. *Seeds* angular, with erenate ribs.

19. *S. tenerrimus*. Clammy Sow-thistle. Linn. Sp. Pl. 1117. Willd. n. 18. Ait. n. 8. Sm. Fl. Græc. Sibth.

t. 790, unpublished. Tour on the Continent, v. 2. 313.— (*Hieracium foliis in tenues lacinias profundè sectis, flore luteo*; -Pluk. Phyt. t. 93. f. 3. *Chondrilla lutea*; Bauh. Hist. v. 2. 1020.)—Flower-stalks downy, somewhat umbellate. Calyx hairy. Leaves deeply pinnatifid, with parallel, oblong, toothed, bluntish segments; their base somewhat arrow-shaped.—Native of rocks and old walls, in Italy, Barbary, Crete, and Cyprus, as well as the south of France, flowering in spring. At Rome and Florence it is eaten in fallads, being of a more delicate, less bitter, flavour than *S. oleraceus*, from which it is also readily known, by the almost pectinate lobes of its leaves, hairy viscid calyx, and a much more elegant and slender aspect in the whole plant. The root is annual.

20. *S. chondrilloides*. Scaly Sow-thistle. Desfont. Atlant. v. 2. 226. Willd. n. 19. Sm. Fl. Græc. Sibth. t. 791, unpublished. (*Chondrilla ficula tragopogonoides maritima*; Bocc. Sic. 13. t. 7. f. 1.)—Flower-stalks elongated, scaly, single-flowered, somewhat corymbose. Calyx smooth; its outer scales heart-shaped. Radical leaves deeply pinnatifid, toothed: those of the stem oblong, toothed; heart-shaped at the base.—Native of sandy ground, in Barbary, Sicily, and Zante. Root perennial. Herb smooth, somewhat glaucous, with more radical, and fewer stem-leaves, than the last. Flowers large, yellow. Outer scales of the calyx, like those scattered over the flower-stalks, heart-shaped, pointed, with a broad, white, membranous border.

21. *S. hispanicus*. Spanish Sow-thistle. Jacq. Hort. Schoenbr. v. 2. 9. t. 143. Willd. n. 20.—Flower-stalks scaly, swelling upward, somewhat corymbose. Calyx-scales recurved. Leaves pinnatifid, toothed, clasping the stem, glaucous, with white downy dots. Found near Malaga, in Spain. An annual, milky herb, flowering from June to August. Jacquin. Stem a foot high, branching from the base, spreading, glaucous, and covered, like both sides of the leaves, with white dots, which prove, under a magnifier, tufts of down. Flowers smaller than the last, and more like the following, especially in their dark-purple central tint; but differing from both in the recurved points of their calyx-scales, whose white membranous margins, moreover, are crisped, or undulated.

22. *S. tingitanus*. Tangier Sow-thistle. Lamarck Dict. v. 3. 397. Willd. n. 21. Sm. Fl. Græc. Sibth. t. 792, unpublished. (*S. tingitanus, papaveris folio*; Tourn. Inf. 475. *Scorzonera tingitana*; Linn. Sp. Pl. 1114. Curt. Mag. t. 142. *S. orientalis*; Linn. Sp. Pl. 1113. Willd. Sp. Pl. v. 3. 1507. *Chondrilla tingitana, floribus luteis, papaveris hortensis folio*; Herm. Lugd-Bat. 657. t. 659.)—Flower-stalks swelling upward, slightly scaly. Calyx-scales erect, with membranous edges. Leaves pinnatifid, toothed, clasping the stem, glaucous, smooth.—Native of maritime rocks in Barbary and the Levant. Said to have been cultivated at Chelsea above 100 years ago, but it had long been lost, and its seeds were brought, by the writer of this, from Paris, to the garden of his worthy friend Dr. Gwyn of Ipswich, in 1787. The plant is annual, flowering in autumn, and its glaucous leaves, finely contrasted with the golden, purple-eyed flowers, make a striking appearance. The purple-tipped white-edged scales of the calyx also contribute to the beauty and singularity of the whole. That this plant is a *Sonchus*, not a *Scorzonera*, is evident to all who look at its seed-down, and the Linnæan herbarium proves *Scorzonera orientalis*, gathered by Hasselquist, to be the very same species.

23. *S. picroides*. Various-leaved Sow-thistle. Lamarck

Dict. v. 3. 398. Willd. n. 22. Allion. Pedem. v. 1. 223. t. 16. f. 1. Sm. Fl. Græc. Sibth. t. 793, unpublished. (*Scorzonera picroides*; Linn. Sp. Pl. 1114. *Crepis Dalechampi*; Dalech. Hist. 562.)—Flower-stalks swelling upward, scaly. Calyx-scales close-pressed, with slightly membranous edges. Leaves toothed; radical ones somewhat lyrate; the rest clasping the stem, obovate-oblong; uppermost linear, nearly entire. Native of the south of France, Barbary, Greece, Cyprus, and the Archipelago; sent by M. Richard to Kew, in 1773. It is a hardy annual, flowering in summer. The herb is smooth, rather glaucous, varying much in luxuriance, and the leaves of the same plant differ greatly in shape. The radical ones are runcinate and lyrate; being rarely obovate, and merely bordered with small teeth, like the rest. Flowers of a uniform yellow, above an inch broad, solitary, on a slightly scaly elongated stalk, at the end of each branch. The scales of the stalks, like the outer ones of the calyx, are heart-shaped, pointed, small, close and flat, with a narrow white edge. Although Plukenet's t. 61. f. 5, cited by Linnæus and Willdenow, bears some resemblance to the leaves of the species before us, yet that, being of English growth, can hardly be any thing else than a variety of *S. oleraceus*, to which we have often seen near approaches in that variable plant; see n. 18, §.

24. *S. crepioides*. Hawkweed Sow-thistle. (*Scorzonera crepioides*; Poiret in Lam. Dict. v. 7. 25.)—Flower-stalks naked, somewhat panicled. Stem much branched, rather downy as well as the calyx, whose outer scales are oval.—Gathered by M. Poiret, on the coasts of Barbary. His description of the fine, silky, simple seed-down, and naked receptacle, induces us to refer the plant to *Sonchus*. He describes it as having the aspect of *Crepis biennis*; but he knew not its leaves, nor the lower part of its herbage. Each division of the stem has, at its base, a little, clasping, linear-lanceolate, pointed, downy leaf. Flowers of a middle size, yellow. Calyx oval, close; its inner scales long, narrow, downy, or farinaceous; outer very short and oval.

25. *S. dichotomus*. Forked Sow-thistle. Willd. n. 23. (*Scorzonera dichotoma*; Vahl. Symb. v. 2. 89. Desfont. Atlant. v. 2. 450. *Lactuca flava*; Forsk. Ægypt-Arab. 143.)—"Flower-stalks scaly, of equal thickness throughout. Stem forked, almost leafless. Radical leaves runcinate."—Gathered by Forskall in the vale of Surdûd, in Arabia Felix, and by Vahl in the kingdom of Tunis. The herbage is smooth. Stems divided from the base into rigid forked branches, bearing in their lower part two lyrate leaves, like the radical ones, but otherwise only small, lanceolate, or ovate, entire ones under each subdivision. Flowers terminal, solitary, yellow. Calyx very smooth; its outer scales ovate, loose, with broad white edges.

26. *S. Plumieri*. Pyrenean Blue Sow-thistle. Linn. Sp. Pl. 1117. Willd. n. 24. Ait. n. 11.—Flower-stalks panicled, smooth, with clasping, long-pointed bractæas. Leaves pinnatifid, pointed, runcinate.—Native of the Pyrenees. It is also found, though rarely, on the Alps of Switzerland, having been observed by M. Favrod, on the mountain called Deut de Jamare, and above Queveisimen, in Teufelsgraben. We have seen this fine plant in some curious gardens, but cannot find it any where figured. The root is perennial. Stem often as tall as a man, round, branched, striated, leafy, smooth and glaucous like every other part of the herbage. Leaves one or two feet long, deeply pinnatifid, with numerous, pointed, opposite, parallel, sharp-toothed segments, and a terminal, pointed, triangular lobe; their base dilated, clasping the stem; under side most glaucous.

Flowers

Flowers numerous, large, pale blue, less vivid than those of the Wild Succory. *Braçteas* smooth, rounded at the base, with long, taper points. *Calyx* smooth. Its outer scales somewhat cordate.

27. *S. macrophyllus*. Large-leaved Hairy Blue Sow-thistle. Willd. n. 25. Pursh n. 3. (*S. canadensis*; Froelich in Uster's Annal. v. 1. 29. S. n. 1; Gronov. Virg. ed. 2. 115. "Chondrilla sylvestris alta, flore cæruleo specioso, foliis sinuatis longis acuminatis alternis, leviter hirsutis, caule ad cacumen ramoso, femine nigro, pappis albis et quasi argenteis instructo; Clayt. n. 139.")—*Flower-stalks* hairy, paniced. *Leaves* lyrate; heart-shaped at the base; hairy beneath.—In shady low grounds, near springs, from Pennsylvania to Carolina, flowering in August and September. From four to seven feet high. *Flowers* blue, the size of *Cichorium Intybus*. *Root* tuberous. *Pursh*. Mr. Froelich, above quoted, describes this species as having for some years been cultivated in the botanic garden at Erlang, with simple, spatulate radical *leaves* a foot long, which wither before the *flowers* come to perfection; their ribs and veins hairy beneath; the *stem-leaves* lyrate, toothed, somewhat fringed; much dilated, heart-shaped, rounded, and finely toothed, at the base; paler and hairy beneath; their terminal lobe very large, triangular, in some degree heart-shaped; the intermediate ones ovate, obtuse, unequal: *upper leaves* more simple, spatulate, very broad at their base, with scarcely any intermediate lobes. *Panicle* with alternate, hairy, subdivided, unequal branches; the upper ones longest and most compound. *Flower-stalks* unequal, erect, densely clothed with glutinous hairs, and bearing one or two scales. *Braçteas* lanceolate, pointed, hairy, much shorter than the partial stalks. *Calyx* half an inch long, cylindrical, pale violet; its inner scales about fourteen, linear, equal, thin at the edges; outer shorter, scattered, unequal, closely imbricated, a little hairy at the back. *Florets* from thirty-four to forty, of a purplish flesh-colour, with hairy tubes. *Seeds* ovate-oblong, triangular, striated. *Down* sessile, roughish, very white. *Odour* of the plant like opium, disagreeable, as well as the *taste*, which is bitter. Of this little-known species we suspect there is an imperfect specimen in the Linnæan herbarium, first marked as having been communicated by Kalm, and then by Gmelin, a reference to *Sonchus*, n. 12. Fl. Sibir. v. 2. 12. t. 4. f. 1, being at the back. This last is an error, the said figure answering best to *S. alpinus* of most authors, *cæruleus* of Fl. Brit. which we suspect to have been Gmelin's plant. He mentions having seen but a single specimen, or we should think it had been one of his, now also in our hands, which Linnæus, by a parallel error to the above, has marked as coming from Kalm, and described by the name of *canadensis*. At least, Linnæus's having confused himself about these two specimens, may account for his describing as a Canadian plant, what no one has ever found in that country; for Mr. Pursh evidently admits it on report only, by the name of *alpinus*.

28. *S. cæruleus*. Alpine Hairy Blue Sow-thistle. Camer. Epit. 281. Fl. Brit. n. 1. Engl. Bot. t. 2425. (*S. canadensis*; Linn. Sp. Pl. 1115. *S. montanus*; Lamarck Dict. v. 3. 401. *S. alpinus*; Willd. n. 26. Ait. n. 12, excluding the reference to Fl. Lapp. Pursh n. 4. Froelich in Ust. Annal. v. 1. 26. Fl. Dan. t. 182. *S. cæruleus latifolius*; Bauh. Hist. v. 2. 1005. *S. flore cæruleo*; Ger. Em. 294. S. n. 20; Hall. Hist. v. 1. 9.)—*Flower-stalks* hairy, racemose, with setaceous bractæas. *Leaves* somewhat lyrate; arrow-shaped at the base; their terminal lobe triangular, very large.—Native of alpine pastures in various parts of Europe, flowering in July and August. The late

Mr. G. Don found it on Lochnagore, Aberdeenshire, which is the only authority for retaining it in our Flora Britannica; *S. alpinus* of former British writers being only *Cichorium Intybus*, admitted on the word of a Northumberland writer, scarcely more correct than he who described the lemon, as growing on the bleak Welsh crag of Penmaen Mawr. This species has a fleshy, perennial, tufted root. *Stems* about a yard high only, simple, leafy. *Leaves* consisting chiefly of a large, triangular, toothed, sharply-pointed lobe, on a bordered, slightly pinnatifid, stalk, clasping the stem with an arrow-shaped base; the under side glaucous, with now and then a few hairs on the rib; the uppermost *leaves* are often quite linear, and merely fringed. *Cluster* terminal, solitary, erect, many-flowered, scarcely compound, its stalks, like the *calyx*, rough with copious, red, glutinous, prominent hairs. *Braçteas* linear or setaceous. *Corolla* of a fine blue. *Antlers* red. *Seed-down* roughish.

Linnæus originally confounded this with his true *S. alpinus*, which has given rise to much confusion and controversy; for authors, indolently following some of his synonyms, without regarding his definitions, have been thus led widely astray; nor can we screen their errors, by allowing them to change a fixed and primary Linnæan name. The learned and candid Mr. Froelich only has any claim to attention on this subject. He would call this plant *alpinus*, because Linnæus has, in *Philosophia Botanica*, p. 273 & 274, inadvertently spoken of his true *alpinus*, by the name of *lapponicus*. So has he there called his *oleraceus, levis*; his *palustris, belgicus*; and his *Cichorium Intybus, scanense*; all which errors he has corrected in his own copy of the work; nor did he dream of their misleading any body. Even Lamarck has used the name of *alpinus*, according to its original destination, and so we shall presume still to apply it; see the following species.

29. *S. alpinus*. Alpine Scaly Blue Sow-thistle. Linn. Sp. Pl. 1117. Fl. Suec. ed. 2. 269, excluding all, except Linnæan, synonyms. Fl. Lapp. ed. 2. 240. Lamarck Dict. v. 3. 400. Sm. Plant. Ic. t. 21. (*S. lapponicus*; Froelich in Ust. Annal. v. 1. 26. Willd. n. 27.)—*Flower-stalks* scaly, racemose, erect. *Leaves* pinnatifid, pointed, toothed, smooth; glaucous beneath. *Stem* simple.—Found by Linnæus on the sides of hills, and in valleys, among the Lapland alps, where it is extremely common, though not known in any other part of the world. The Laplanders peel the stalks, before flowering, and eat the fleshy part, which Linnæus thought too bitter, without the usual seasoning of a salad. He speaks of this plant as extremely handsome, the height of a man, or taller, with a straight, rigid, leafy stem. The *leaves* are smooth and shining, deeply pinnatifid, sharply toothed; rounded, but not dilated nor clasping, at the base; glaucous beneath. *Cluster* more or less compound, long, dense; its stalks not at all hairy or downy, but clothed with imbricated, concave, acute, sheathing scales. *Flowers* blue, about half the size of the last, but much more numerous. *Calyx* ovate, smooth. The late professor Willdenow informed us, in 1796, that this rare plant was then growing luxuriantly, in the garden of Mr. Krause, at Berlin. He favoured us with seeds, but they did not succeed. The root is marked as biennial.

30. *S. leucophæus*. Pale-blue American Sow-thistle. Willd. n. 28. Pursh n. 5. (*S. spicatus*; Lamarck Dict. v. 3. 401.)—*Flower-stalks* scaly, racemose, drooping. *Leaves* pinnatifid, toothed, smooth. *Stem* wand-like, paniced.—On the borders of woods, by road sides, from New England to Virginia, flowering from July to September. *Root* biennial. *Flowers* small, white tinged with blue. *Pursh*. Lamarck

says the *stem* is only two or three feet high. *Leaves* narrow; the upper ones small, linear, and entire.

31. *S. floridanus*. Small-flowered Florida Sow-thistle. Linn. Sp. Pl. 1118. Willd. n. 13. Pursh n. 6.—Flower-stalks panicled, distantly fealy. *Leaves* somewhat lyrate, minutely toothed, smooth, with a large, triangular, acute, terminal lobe.—On road sides, in the shady woods of Virginia and Carolina, flowering from July to September. *Root* biennial. *Leaves* a span long, of two large lobes, besides the much larger terminal one; narrow and linear at the base. *Panicle*, or *cluster*, doubly branched, spreading. *Flowers* very small, blue. Mr. Pursh says, this plant has been used for curing the bite of the rattle-snake, in the same manner as his *Prenanthes serpenticaria*, and is known by the name of Gail of the earth.

32. *S. acuminatus*. Pointed-leaved Sow-thistle. Willd. n. 30. (*Lactuca villosa*; Jacq. Hort. Schoenbr. v. 3. 62. t. 367?) —“Flower-stalks slightly fealy, panicled. Radical leaves somewhat runcinate; those of the stem ovate, pointed, stalked.”—In low shady places, from Pennsylvania to Virginia, flowering in August and September. Biennial. *Flowers* small, blue. *Pursh*. *Stem-leaves* tapering at each end, and furnished at each side, in the middle, with small pointed teeth. It differs from *S. floridanus* in these leaves being undivided. They are also slightly hairy beneath. The *panicle* was slender, composed of few *flowers*, in Willdenow's wild specimen, and the *seed-down* sessile. Jacquin's figure exhibits a triply-compound *panicle*, of innumerable small pale-blue *flowers*, and he unluckily does not mention the *seed-down*. We know nothing of this species, but from these authorities. It appears akin to the last, though sufficiently distinct.

33. *S. pallidus*. Pale-yellow Canadian Sow-thistle. Willd. n. 31. Ait. n. 14. Pursh n. 8. (*Lactuca canadensis*; Linn. Sp. Pl. 1119.)—Cluster compound, with fealy stalks. *Leaves* lanceolate, toothed, smooth, clasping the stem; the upper ones taper-pointed.—On road sides, and in woods, from Canada to New England, flowering from July to September. Perennial. *Flowers* small, yellow. *Pursh*. The scales of the *flower-stalks* are ovate, pointed, crowded and recurved. *Cluster* dense. *Calyx* very smooth. *Seed-down* quite sessile. The *leaves* are not properly sword-shaped. Mr. Pursh cites under this species Robert's *Icones* t. 148 and 151, which we have not been able to consult.

34. *S. pulchellus*. Beautiful Blue Sow-thistle. Pursh n. 9.—“Flower-stalks fealy, in a corymbose cluster. *Stem-leaves* ovate-oblong, acute, entire, smooth; with a clasping heart-shaped base.”—On the banks of the Missouri, flowering in September. Perennial. *Flowers* large, of a beautiful blue. *Pursh*.

35. *S. fliricus*. Willow-leaved Sow-thistle. Linn. Sp. Pl. 1118. Willd. n. 32. Ait. n. 15. (S. n. 11; Gmel. Sib. v. 2. 11. t. 3. *Lactuca falsis folio*, n. 211 and 212; Amm. Ruth. 150.)—Flower-stalks corymbose, with distant lanceolate scales. *Leaves* lanceolate, sessile; the upper ones entire; lower variously toothed.—Found throughout Siberia, as well as about the river Wolga, and in some parts of Russia and Finland. The *root* is perennial, creeping extensively. *Stem* from one to four feet high, leafy, wand-like; sometimes branched in the upper part. *Leaves* numerous, about four inches long, very smooth and even; rather glaucous at the back. *Flowers* blue, about an inch in diameter, composing a level-topped corymb.

36. *S. tataricus*. Tartarian Sow-thistle. Linn. Mant. 572, excluding the synonym. Willd. n. 33. Ait. n. 16.—Flower-stalks racemose, nearly naked. *Leaves* lanceolate,

runcinate.—Native of Siberia and Tartary. Perennial, flowering in June and July. A rather larger plant than the last; the teeth of its *leaves* large, pointing backward. *Flowers* blue, in compound clusters, terminating the stem and branches.

37. *S. prenanthoides*. Long-clustered Sow-thistle. “Marschall von Bieberstein.” Fischer MSS.—Flower-stalks racemose, lateral and terminal, fealy, downy. *Leaves* elliptic-oblong, toothed, somewhat fiddle-shaped.—Native of mount Caucasus. The *stem* is round, terminating in a long series of alternate, shortish, somewhat compound, *clusters*, whose partial stalks are cottony and fealy. The *flowers* seem to be blue or purplish. *Leaves* smooth, somewhat stalked, three or four inches long, an inch and half broad, finely toothed; the upper ones diminishing into lanceolate narrow *bractæas*.

SONCINO, in *Geography*, a town of Italy, on the Oglio; 8 miles E.N.E. of Crema.

SONDAU, a town of Brandenburg, in the duchy of Magdeburg; 50 miles N.N.E. of Magdeburg.

SONDELY, a town of Norway, in the province of Bergen; 30 miles S.S.W. of Romfald.

SONDERBORG, a sea-port town of Denmark, on the S. coast of the island of Alsén, with a royal palace, and one of the best harbours in Denmark. In this palace Christian II. king of Denmark, was confined as a prisoner for 13 years: the inhabitants are chiefly seamen: 16 miles E.N.E. of Flensborg. N. lat. 54° 57'. E. long. 9° 59'.

SONDERSHAUSEN, a town of Germany, in the county of Schwartzburg, situated on the Wipper. On an eminence without the town stands the palace, where the ruling prince of the Sondershausen line usually resides; 20 miles N.E. of Mulhausen. N. lat. 31° 22'. E. long. 10° 57'.

SONDERSITZ. See URSITZ.

SONDHEIM, a town of the duchy of Wurzburg; 7 miles N. of Bischofsheim.

SONDRE GRUND, or BOTTOMLESS, an island in the South Pacific ocean, discovered by Le Maire and Schouten, in 1616; about 20 leagues in circumference, long but not broad. It appeared covered with trees, among which were palm-trees and cocoa-nut trees. It had no anchoring ground. The inhabitants were naked, except a piece of mat round the middle, of a yellowish or reddish-brown colour, and black hair; their skin was marked with many figures: they were covetous of iron, and thieves. S. lat. 15°. W. long. 148°.

SONDRIO, or SONDERS, a town of Italy, and capital of the Valteline, partly on a plain and partly on the side of a rock, in a romantic situation, at the extremity of a narrow valley, on a small river which runs into the Adda; 15 miles E. of Chiavenna. N. lat. 46° 6'. E. long. 9° 50'.

SONE, a town of Bengal; 8 miles S.E. of Ramgur.

SONEGA, a town of Holland, in Friesland; 9 miles E. of Kuynder.

SONEGUERA, a town of Mexico, in the province of Honduras; 32 miles N. of St. Jorge de Olancho. N. lat. 15° 15'. W. long. 86° 40'.

SONEHUTCH, a town of Hindoostan, in Malwa; 30 miles N.E. of Indore.

SONENBERG, a town of Germany, in the county of Pludentz; 4 miles N. of Pludentz.—Also, a town of the New Mark of Brandenburg; 6 miles E. of Cultrin.

SONEPOUR, a town of Hindoostan, in Orissa, on the Mahanada; 38 miles S. of Sumbulpour. N. lat. 20° 47'. E. long. 83° 40'.

SONERGONG. See SUNERGONG.

SONEWALDT, a town of Lufatia; 8 miles S. of Luckau.

SONEY, a town of Hindooftan, in Malwa; 9 miles E. of Saurungpour.

SONG, a town of Africa, in Bambarra, on the Niger. N. lat. $13^{\circ} 54'$. W. long. $3^{\circ} 55'$.

SONG, a town of China, of the third rank, in Ho-nan; 37 miles S.S.W. of Ho-nan.

SONG SONG, a small island in the Indian sea, near the coast of Africa. S. lat. $8^{\circ} 12'$.

SONG, in *Poetry*, a little composition, consisting of simple, easy, natural verses, set to a tune, in order to be sung.

Each stanza of a song is called a *couplet*.

The song bears a great deal of resemblance to the madrigal, and more to the ode; which is, indeed, nothing but a song, according to the ancient rules.

Its object is usually either wine or love, whence M. le Brun defines a modern song, to be either a soft and amorous, or a brisk and Bacchic thought expressed in few words.

Indeed, this is to restrain it to too narrow bounds; for we have devout songs, satyrical songs, and panegyrical songs. But, be the song what it will, the verses are to be easy, natural, and flowing; and are to contain a certain harmony, which neither shocks the reason nor the ear; and which unites poetry and music agreeably together.

Anciently, the only way of preserving the memory of great and noble actions, was by recording them in songs; and, in America, there are still people who keep their whole history in songs.

Songs have at all times, and in all places, afforded amusement and consolation to mankind: every passion of the human breast has been vented in song; and the most savage as well as civilized inhabitants of the earth have encouraged these effusions. The natives of New Zealand, who seem to live as nearly in a state of nature as any animals that are merely gregarious, have their songs, and their *improvvisatori*; and the ancient Greeks, during every period of their history and refinement, had their *scolia* for almost every circumstance and occasion incident to society.

Singing was so common among the ancient Romans as to become proverbial. Phædrus, in the Phormio of Terence, begs Dorio to hear him, he has but one word to offer; when Dorio tells him he is always singing the same song. Horace speaks of the same affectation among the singers of his time as prevails with the present; never to sing when they are entreated, or to desist if no one wishes to hear them. And some idea of the cultivated state of music in Gaul, so early as the fifth century, may be acquired from a passage in one of the epistles of Sidonius Apollinari, who, in his character of king Theodoric the Goth, says, that "this prince was more delighted with the sweet and soothing sounds of a single instrument, which calmed his mind, and flattered his ear by its softness, than with hydraulic organs, or the noise and clangor of many voices and instruments in concert."

Clothaire II. in the seventh century, having gained a great victory over the Saxons, it was celebrated by a Latin song in rhyme, which the annalists tell us was sung with great vociferation all over the kingdom.

As the origin of songs and the formation of the language of every country are so nearly coeval, we hope the reader will allow us to bestow a few columns on a subject which, though it may not be thought absolutely necessary for a musical lexicographer, or even historian to trace, yet it lies so near his path, that he can hardly proceed on his way with-

out its being impressed on his mind fortuitously. For the songs of the ancient Greeks, see SCOLIA.

But in enquiring after the most ancient songs in modern languages, we shall not enter upon the merits of a question which has been much agitated in France during the middle of the last century, "Whether the present language of that country was first cultivated in the northern or southern provinces?" The origin of all inventions, after having been suffered by ignorance and idleness to sleep for many ages, is so difficult to ascertain, that if the inhabitants of the kingdoms which gave them birth, where information is most likely to be furnished, are unable to bring them to light, it would be arrogance in a foreigner to attempt it. The French critics and antiquaries all agree that the capital was the last place to cultivate the vulgar tongue, and to receive the first essays of those who made it the vehicle of their thoughts. Fontenelle says the first sparks of poetry appeared chiefly at the two extremities of the kingdom, in Provence and Picardy. "The Provençaux," says he, "warmed by a more genial sun, ought to have had the superiority; but the inhabitants of Picardy are their inferiors in nothing." M. de la Ravière gives the honour of priority to the writers of Normandy; and Fauchet and Pasquier, separating the French poetry from the Provençal, challenge the admirers of the Troubadours to produce verses of their writing of equal antiquity with the specimens of French poetry which they have exhibited. However, the Provençal bards have lately had many able champions, among whom M. de Lacurne de Sainte Palaye, and his faithful 'quire, M. Millot, have distinguished themselves. And though it cannot be denied but that fragments of songs subsist in the French language of higher antiquity than in the dialect of Provence, yet, as we have been able to find no melodies that have been set to a modern language more ancient than those that have been preserved in the Vatican library to the songs of the Troubadours, we shall begin our enquiries concerning the origin of vulgar dialects in Europe, by endeavouring to trace the first formation of the language of Provence.

Every refined and polished nation has a vulgar language in its remote provinces, and even in its capital, among the common people, in which there are innumerable words and phrases that have never been admitted into books. This must doubtless have been the case with the Romans; and it is the opinion of some persons of great eminence in literature, among whom may be numbered the learned cardinal Bembo, and the marquis Maffei, that the ancient Romans had at all times an oral vulgar language which was different from that of books; and that this colloquial language, less grammatical and elegant than that of the learned, was carried by the Romans into all the provinces under their dominion. It is therefore probable that this, and not the written language of Italy, was the mother of the Provençal, Sicilian, Italian, and Spanish dialects.

But supposing such a language as Cicero's was ever spoken, it could not be laid aside for another all at once; and when we are told of a particular period or century, during which the Latin tongue ceased to be spoken in France or Italy, and the Provençal, French, or Italian begun; credulity itself is staggered, and unable to reconcile it to probability. Every language is long spoken before it is written; and though the first poet of Italy or Provence, who committed his verses to writing in the vulgar tongue, could be named, no one would venture to tell us by whom it was first spoken.

The learned Maffei is of opinion that there was a vulgar language in Italy long before the irruptions of the Lombards, Goths,

Goths, or Franks; and has traced its use as early as the time of Quintilian, who tells us, that he had often heard the crowd in the Circus applaud, or demand something of the champions, in a barbarous language; that is, in a vulgar and plebeian dialect, different from pure Latin. Sammonicus, who lived in the time of Septimius Severus, names the vulgar language. And both Pliny and St. Jerome speak of the military language as of that kind; the latter even tells us that Fortunatianus, bishop of Aquileia, wrote a commentary on the Evangelists in this vulgar language, *ruffico sermone*, during the time of Constantine. But this was a singular instance, which was not imitated.

It appears, however, from the Dialogues of St. Gregory the Great, written 593, that there was then a language merely colloquial at Rome. For he tells us that a new convert, of whom he is speaking, was sent to a convent with two vessels of wine, which the vulgar call flasks.

And Gregory of Tours, so early as 572, complains of this vulgar or rustic tongue gaining ground in France, and being more in favour than Latin, the language of the learned.

It was therefore by degrees that Latin ceased to be understood by the common people, and the Romance language had admission into books. And in 813 it was ordered by a canon at the council of Tours, that the bishops should be employed in translating homilies into the Roman rustic tongue, that they might be the more easily understood by the common people. The same canon, we are told, was renewed in a council at Arles in 851.

In the ninth century historians tell us, that Charlemagne and his sons and successors spoke the Romance language, specimens of which may be seen in Fauchet, Pasquier, and several other writers on the French language. And in the twelfth century it began to be the general language of poets and polite writers. Some of the sermons written and preached by St. Bernard, about 1137, in this language, are still preserved among the MSS. of the convent of Feuillans, in the rue St. Honoré at Paris.

The colloquial language used only in familiar conversation was called by the Romans *sermo usualis, quotidianus, pedestris, vulgaris, miliaris, rufficus*, &c. It is supposed by M. Bonamy, as well as by others, that from this vulgar Latin not only the French language and its different dialects but the Spanish and Italian are derived. Indeed, it is most probable that the Latin tongue, in its periods of greatest purity, was only the language of the learned, in the Roman provinces remote from the capital; and that it was never so generally cultivated in other times as to exclude the vulgar dialect.

In the frequent revolutions and struggles for empire during these ages, the Roman language must have been debased and corrupted, while new tongues were forming, which, though not sufficiently fixed and grammatical to be used in books, were doubtless long the vulgar and colloquial dialects before the Latin ceased to be the common language of the learned.

It was about this time that the art of rhyming, or unisonous terminations of verses, stole into poetical composition, in a manner which the learned and judicious author of an Essay on the Language and Versification of Chaucer, seems to have traced to its source. Leonine verses, supposed to have been so called from a pope or monk Leo, their author, in the seventh century, are by some thought the first attempt at rhyme; while others imagine the hymn to St. John the Baptist, by Paul Diaconus, written about the latter end of the eighth century, to be not only rendered memorable by Guido's scale, but by having been the model of all other

monkish rhymes in Latin, as well as in modern languages. *Ut queant laxis*, &c.

But neither of these genealogies satisfies all enquirers. Gravina thinks it as absurd to ascribe the invention of rhyme to any one writer, as to attribute to an individual the propagation of the plague, which is caused by the universal contagion of the air.

The Arabs had rhyme, according to Don Calmet, before the time of Mahomet, who died 632, and in the second century used a kind of poetry in measures similar to the Greek, and set to music. See RHYME.

While the new languages were unsettled, and but partially known, even in the single kingdom or province where they were forming, it was not uncommon to write half a poem in Latin and half in a vulgar tongue. Indeed Dante has left a poem in three languages, Latin, Provençal, and Italian; and Rambaud de Vachieras, a Provençal poet, in five.

Petrarca and Muratori think that the Sicilians first composed and wrote songs in a vulgar language; that from them the custom went into Provence, and from Provence into Italy. Indeed Sicily and Provence were long under the dominion of the same princes, and the same language may have been cultivated at the courts of both countries; but as no vestiges remain of Sicilian poetry resembling the Provençal, the opinions of these authors, however eminent, and, on other accounts, respectable, while unsupported by reasons and facts, can have but little weight.

Cardinal Bembo, however, was of opinion that the first rhymers and poets who wrote in a modern language were of Provence; after them the Tuscans, who had more assistance from them in their poetry than from any other people. And both Crescembeni and Gravina make the same concession.

Nollradamus, in his lives of the Provençal poets, says that Provence was called the mother of Troubadours and Minstrels; and that Dante, Petrarca, Boccaccio, and other Tuscan poets, enriched both their language and fancy from the productions of his countrymen. However, as no *versi sciolti*, or poetical lines without rhymes, are to be found in the Provençal poets, though they abound among the Italians, it is natural to suppose that in these measures of blank verse the Italians imitated their ancestors the Romans, and that in rhyming, the Provençals were their models.

It was the opinion of Voltaire that this language began to be formed in the ninth century, out of Latin and Teutonic; that it was the mother of French, Spanish, and Italian; "continued in favour till the reign of the emperor Frederic II. and is still spoken in some villages of the Grisons, and near Switzerland."

Carpentier derives the word Troubadour from *Troba*, Provençal, *figmentum*. *Hinc Troubadours appellati poete Provinciales*.

It was in the eleventh century, during the first crusade, according to the abbé Millot, that Europe began to emerge from the barbarous stupidity and ignorance into which it had long been plunged. And while its inhabitants were exercising every species of rapine, plunder, and pious cruelty in Asia, art, ingenuity, and reason, insensibly civilized and softened their minds.

It was then that the poets and songsters known by the name of Troubadours were multiplied, and their profession honoured by the patronage and encouragement of the count of Poitou, and many other powerful princes and barons, who had themselves successfully cultivated poetry and music. At the courts of these munificent patrons they

were treated with the greatest consideration and respect. The ladies, whose charms they celebrated, gave them the most generous and flattering reception; and sometimes disdained not even to listen with compassion to tales of tenderness, and descriptions of the hawk which the irresistible charms of these sublunary divinities of chivalry had made in their hearts. The success of a few inspired the rest with hope, and excited exertions in the exercise of their art, which impelled them towards perfection with a rapidity that nothing but the united force of emulation and emolument could occasion.

As these founders of modern versification, these new poetical architects, constructed their poems upon plans of their own invention; and as all classical authority was laid aside, either through ignorance or design, each individual gave unlimited indulgence to fancy in the subject, form, and species of his composition. And it does not appear, during the cultivation and favour of Provençal literature, that any one Troubadour so far outstript his brethren in the approaches he made towards perfection, as to be considered as a model for his successors. We find, though military prowess, hospitality, Gothic gallantry, and a rage for feasts and revelry prevailed, that taste, refinement, and elegance, were never attained during this period, either in public or private amusements. The want of originality of composition is frequently lamented when licence is repressed by laws, and the wild effusions of an ardent imagination are bounded by authority; but the productions that have been preserved of the Provençal bards, which may be called the offspring of writers in a state of nature, seem to prove the necessity of rule, order, and example, even in the liberal arts as well as the government of a free state. For the progress of taste must ever be impeded by the ignorance and caprice of those who cultivate an art without science or principles.

During near two centuries after Guido's arrangement of the scale and invention of the time-table ascribed to Franco, no remnants or records of secular music can be found except those of the Troubadours, or Provençal poets. And though in the simple tunes which have been preserved of these bards, no time is marked, and but little variety of notation appears, yet it is not difficult to discover in them germs of the future melodies, as well as poetry, of France and Italy. Unluckily the poetry and music of the Troubadours of Provence were not for a long time called into notice by writers possessed of those blandishments of style or manner which fascinate, and render whatever subject they treat interesting to the generality of readers. Fauchet, Pasquier, and Noltradamus have written in a language that is now become so uncouth and difficult, that few have the courage to attempt acquiring information or amusement from it; and Muratori and Crescimbeni, who are respected for their diligence and exactitude, are certainly dry and dull narrators of facts which promise delight to every lover of literature; nor do we remember, in consulting their voluminous writings, ever to have found them guilty of hazarding a single reflection or conjecture that has embellished the subject, or rendered it amusing. But this censure must not be applied to Sainte-Palaye, Bonamy, la Raviere, and Barbazan, who, in the *Memoires de Litterature* and elsewhere, have not only embellished, but nearly exhausted the subject. Indeed, the period of Provençal poetry is interesting to literature, and the melody to which it was sung is a subject of curious enquiry to a musical historian; for it is generally allowed that the Troubadours, by singing and writing in a new tongue, occasioned a revolution not only in literature but the human mind. And as almost every species of Italian poetry is derived

from the Provençals, so air, the most captivating part of secular vocal melody, seems to have had the same origin. At least the most ancient strains that have been spared by time, are such as were set to the songs of the Troubadours. See TROUBADOURS.

Songs seem in a particular manner to belong to the language of Italy. The ancient Romans were no great songsters; and by what degrees the Latin language became Italian, would be a tedious and difficult enquiry. We know when the musical drama or opera was established, and consequently when opera airs, with instrumental accompaniments, began first to be cultivated; but these are not the subjects of our present research: but when national melodies, for such every country has, were first applied to songs in the Italian language, a dialect which has long been universally allowed to be more favourable to singing than any one which the numerous combinations of letters in all alphabets of modern times has produced, we are ignorant. And if the French, Provençal, and Spanish dialects can be deduced from the Latin, how much more easy is it to trace the Italian from that source? which is itself frequently so near pure and classical Latin, that no other change or arrangement of words seems to have been made, than what contributed to its sweetness and facility of utterance.

That the Italian tongue is derived from the vulgar language of the ancient Romans, seems the opinion of the best critics; but to discover and point out by what degrees it was smoothed and polished to the state in which Dante, Petrarca, and Boccaccio found it in the fourteenth century, would require more time, and occupy more space in this article, than the subject seems necessarily to require. However, as the Italian language has been truly allowed to be more musical in itself when merely spoken with purity, than any other in Europe, an enquiry into the causes of its natural melody and melliflence does not seem foreign to the subject of the present article.

Muratori (*Dissert.* 32.) has given innumerable passages from authors of the eighth and ninth centuries, to prove, that after the Franks and Germans were settled in Italy, articles were used in the Latin language instead of pronouns and changes of termination, in order to save the trouble of inflecting the cases in nouns; but pretends not to say what this vulgar language was, or whether the clergy preached to the common people, or merchants carried on their correspondence in Latin or Italian.

The learned Maffei allows the Provençal, French, Spanish, and Italian languages, to be descendants from the Latin, but denies that the ancient inhabitants of Italy adopted any words from the Goths or Huns who invaded them. The genius of the German, Francic, or Teutonic language, which was spoken by the Lombards, was so diametrically opposite to that of the Italians, that it seems incredible there should have been any exchange or union of dialects between them: the one being as remarkable for its numerous consonants and harsh terminations, as the other for its open vowels and mellifluous endings. As it is the opinion of this profound critic that the Romans had always a vulgar dialect, less grammatical and elegant than that of the senate and of books, he supposes the French, Spanish, and Italian languages to have been different modifications of this rustic, plebeian dialect. But it is as difficult to assign a reason for all these daughters of one common mother being so dissimilar, as it is to account for the little resemblance that is frequently found between other children of the same parents. And why the French language should have so many nasal endings, the Spanish so many syllabating, and the Italian alone have none but

vocal terminations, can only have been occasioned by some particular and radical tendency in the vulgar and plebeian language of each country from very high antiquity.

While this language was forming, no music seems to have been cultivated in Italy, except the *canto fermo* of the church; and, unluckily, no written melody can be found to the *Canzoni* of Dante, the sonnets of Petrarca, or the songs of Boccaccio, the three great founders of the Italian tongue. Yet these, we are told, were all set to some kind of music or other, and sung even in the streets. See the biographical articles of these lyric poets, particularly that of Boccaccio; whose "*Decamerone*" has always been regarded as a natural and faithful delineation of the manners and customs of Italy, at the time when it was written.

With respect to music, whether the personages which he assembles together after the plague at Florence 1348, and the stories they tell, are real or imaginary, the amusements he assigns them in his ritual must have been such as were usual to the Florentines, among whom he lived at that time; and indeed the poems that are pretended to have been sung, and the instruments with which they were accompanied, subsisted before this period, and still subsist.

Boccaccio tells us, at the end of his *prima giornata*, or first day, that "after supper the instruments were called in, when the queen, for the day, ordained that there should be a dance; and after one had been led off by Lauretta, Emilia sung a song, in which she was accompanied by Dion, a gentleman of the party, on the lute." There is nothing new or extraordinary in this quotation. But in Italy, whence all the liberal arts have travelled to the rest of Europe, it is curious to know in what rank music was held at this early period, and what use was made of it in polite assemblies, by the inhabitants. And here a writer, justly celebrated for the exactness with which he has described the customs of his contemporaries in all situations, tells us, that in an assembly of persons of birth and education, who passed ten days together during summer in a constant succession of innocent amusements, each evening was closed by dance and song; in which the whole company, consisting of seven ladies and three gentlemen, of different characters and acquirements, were able to perform their parts.

When we are told, that the lady who sang was accompanied by the lute, we know not of what this accompaniment consisted, whether it only fortified the voice-part by playing the same melody, or more elaborately furnished a base and a different treble, arising out of its harmony.

On the second day we find, that one of the company leading off a carol, a song was sung by another, which was answered in a kind of chorus by the rest.

At the close of the second day Boccaccio tells us, that after the song, of which he gives the words, had been performed, many others were sung, and many dances danced to different tunes, by which we may gather, that besides carols and ballads, the singing of which marked the steps of a dance, there were at this time songs without dances, and tunes without songs.

Whoever reads the history of the most ancient inhabitants of this island, the Cambre-Britons, will find innumerable instances of the reverence which they paid to their poet-musicians, the bards both of Pagan and Christian times; and songs of very high antiquity have been preserved in the Welsh language, though not all the tunes to which they were sung.

We are told (*Miscel. Antiq.* vol. ii. p. 8.) that sir Thomas Wyatt was the first who introduced Italian numbers into

English versification. This may have contributed to improve our lyric poetry; but to confess the truth, from the few parts of the first class throughout Europe, who, at the beginning of the sixteenth century, condescended to write madrigals and songs for music, it seems that the rage for canon, fugue, multiplied parts, and dissimilar melodies, moving at the same time, had so much employed the composers, and weaned the attention of the hearers of these learned, or, as some call them, Gothic contrivances, from poetry, that the words of a song seem to have been only a pretence for singing; and as the poets of the two or three last centuries were in little want of music, musicians, in their turn, manifested as little respect for poetry; for in these elaborate compositions, the words are rendered utterly unintelligible by repetitions of particular members of a verse; by each part singing different words at the same time; and by an utter inattention to accent.

In the "*Essays on Song-writing*," published with a collection of English songs (we need not name the author, whom he has not named himself, nor given the date of the publication) there are many judicious and excellent reflections; and the songs are admirably selected, and form the best collection in our language, under the three following heads: "On Song-writing in general;" "On Ballads and pastoral Songs;" "On passionate and descriptive Songs."

We can perceive, however, that the author of these ingenious essays loves poetry better than music; a personage whom he does not treat with common civility, when he says, "the heroine Poetry must give place to the *barlot Music*," notwithstanding her claim to the title of a *lady of fashion*. But we think the two ladies should *ride and tie*. There are songs where the poetry should be respected, and the music subordinate; and others, where music is entitled to pre-eminence.

We wish not fine poetry to have fine music, nor fine music to be manacled by laboured poetry. Lyric poetry cannot be too simple.

The author allows the primitive meaning of a song to signify something to be *sung*: and when he says, "a song, as a poetical composition, may be defined a short piece, divided into returning portions of measures, and formed upon a single incident, thought, or sentiment," we readily subscribe to the definition. Indeed it was our opinion, (see *Italian Tour*;) long before we had the pleasure to peruse these well written essays; and it is an opinion to which Metastasio has constantly adhered, in all his admirable musical dramas.

With regard to pastoral songs, though the Sicilian pastoral is not natural to our climate, yet we produce better fruit for the table in our hot-houses, than the southern continent of Europe can boast. An opera song is a *hot-house plant*. Pastoral songs may have pastoral music, as the Sicilian movement has been happily treated more frequently by Handel, and many of our best national composers, such as Arne and Boyce, than any other. And as for simple ballad tunes for historical and narrative songs, and common ditties, there can be no scarcity; as a collector of our acquaintance, many years ago, had amassed a sufficient number of songs set to music, and printed on a single folio half-sheet, from the latter end of the 17th century, to fill twelve volumes.

For descriptive and passionate songs, we have picturesque and passionate music; and we hope this intelligent and elegant writer will allow the *lady Music* to be tricked out a little in passionate and descriptive songs. Haydn, in his "*Seasons*," has described very happily, we think, rural sports

sports and occupations, and admirably displayed her imitative and picturesque powers, in awakening ideas of the several seasons, and the rustic employments of each.

SPRING.

The overture paints the departure of winter, and approach of spring; ploughing, sowing; a prayer to heaven for prosperity; the youths and virgins going a Maying; chorus of thanks to the Supreme Being, in which is an admirable fugue, equal to the best vocal fugues of Handel.

SUMMER.

The overture paints the dawn of day; the rising sun; choral hymn to that luminary; mowing, reaping; a shady retreat; rural employments, and evening sports.

AUTUMN.

The symphony indicates the husbandman's satisfaction at his plentiful harvest; chorus in praise of industry and labour; fruits gathered; duet between an innocent fond pair; field sports; hunting; vintage; dancing; romping; singing; revelling, and jubilation.

WINTER.

The overture paints thick fogs at the approach of winter; horrors of winter; distresses of travellers; evening domestic amusements; purring of the wheel; a narrative rustic song; moral reflections on winter, set to a fine air, cantabile; future rewards of a life well spent, in the *coro finale*.

Milton's *Allegro and Penferoso*, as set by Handel, which are all *description*, have not been injured by too elaborate music; but these are not the songs nor the music of which we meant to trace the history, when we began the present article. See AIR.

SONG of Birds, is defined by the Hon. Daines Barrington to be a succession of three or more different notes, which are continued without interruption, during the same interval, with a musical bar of four crotchets in an *adagio* movement, or whilst a pendulum swings four seconds.

It is observed that notes in birds are no more innate than language in man, and that they depend entirely upon the matter under which they are bred, as far as their organs will enable them to imitate the sounds which they have frequent opportunities of hearing; and their adhering so steadily, even in a wild state, to the same song, is owing entirely to the nestlings attending only to the instruction of the parent-bird, whilst it disregards the notes of all others that may perhaps be singing round him.

Birds in a wild state do not commonly sing above ten weeks in the year, whereas birds, that have plenty of food in a cage, sing the greatest part of the year: and we may add, that the female of no species of birds ever sings; and this is a wise provision of nature, because her song would discover her nest; and, in the same manner, we may rationally account for her inferiority in respect to plumage. The faculty of singing is confined to the cock birds; and accordingly Mr. Hunter, in dissecting birds of several species, found the muscles of the larynx to be stronger in the nightingale than in any other bird of the same size; and in all those instances, where he dissected both cock and hen, the same muscles were stronger in the cock. To the same purpose, it is an observation as ancient as the time of Pliny, that a capon does not crow.

Some have ascribed the singing of the cock-bird in the spring to the motive only of pleasing his mate, during incubation; nature, indeed, partly for this end, has given to the male the power of singing: but the singing of a bird in

the spring is more probably owing to the greater plenty of plants and insects, which, as well as seeds, are the proper food of singing birds, at that time of the year.

Mr. Barrington remarks, that there is no instance of any bird's singing, which exceeds our black-bird in size; and this, he supposes, may arise from the difficulty of its concealing itself, if it called the attention of its enemies, not only by bulk, but by the proportionable loudness of its notes. This writer farther observes, that some passages of the song, in a few kinds of birds, correspond with the intervals of our musical scale, of which the cuckoo is a striking and known instance; but much the greater part of such song is not capable of musical notations: partly, because the rapidity is often so great, and it is also so uncertain when they may stop, that we cannot reduce the passages to form a musical bar in any time whatsoever; partly also, because the pitch of most birds is considerably higher than the most shrill notes of those instruments which comprehend even the greatest compass; and principally, because the intervals used by birds are commonly so minute, that we cannot judge at all of them from the more gross intervals into which we divide our musical octave. This writer apprehends, that all birds sing in the same key; and in order to discover this key he informs us, that the following notes have been observed in different birds, A, B flat, C, D, F, and G; and, therefore, E only is wanting to complete the scale: now these intervals, he says, can only be found in the key of F with a sharp third, or that of G with a flat third; and he supposes it to be the latter, because, admitting that the first musical notes were learned from birds, those of the cuckoo, which have been most attended to, form a flat third; and most of our compositions are in a flat third, where music is simple, and consists merely of melody. As a farther evidence, that birds sing always in the same key, it has been found by attending to a nightingale, as well as a robin, which was educated under him, that the notes reducible to our intervals of the octave were always precisely the same.

Most people, who have not attended to the notes of birds, suppose, that those of every species sing exactly the same notes and passages, which is by no means true, though it is admitted that there is a general resemblance. Thus the London bird-catchers prefer the song of the Kentish goldfinches, and Essex chaffinches; but some of the nightingale-fanciers prefer a Surrey bird to those of Middlesex.

The nightingale has been almost universally reckoned the most capital of singing birds; and its superiority, deduced from a caged bird, consists in the following particulars: its tone is much more mellow than that of any other bird, though at the same time, by a proper exertion of its musical powers, it can be excellently brilliant. Another point of superiority is its continuance of song, without a pause, which is sometimes no less than twenty seconds; and when the respiration became necessary, it has been taken with as much judgment as by an opera-singer. The sky-lark in this particular, as well as in compass and variety, is only second to the nightingale. The nightingale also sings, if the expressions may be allowed, with superior judgment and taste. Mr. Barrington has observed, that his nightingale, which was a very capital bird, began softly like the ancient orators; reserving its breath to swell certain notes, which by this means had a most astonishing effect. This writer adds, that the notes of birds, which are annually imported from Asia, Africa, and America, both singly and in concert, are not to be compared to those of Europe.

The following table formed by Mr. Barrington, agreeably to the idea of M. de Piles in estimating the merits of

painters, is designed to exhibit the comparative merit of the British singing birds: in which twenty is supposed to be the point of absolute perfection.

	Melodious notes.	Sprightly notes.	Plaintive notes.	Comps.	Execution.
Nightingale - - - - -	19	14	19	19	19
Sky-lark - - - - -	4	19	4	18	18
Wood-lark - - - - -	18	4	17	12	8
Tit-lark - - - - -	12	12	12	12	12
Linnæ - - - - -	12	16	12	16	18
Goldfinch - - - - -	4	19	4	12	12
Chaffinch - - - - -	4	12	4	8	8
Greenfinch - - - - -	4	4	4	4	6
Hedge-sparrow - - - - -	6	0	6	4	4
Aberdavine or fiffin - - - - -	2	4	0	4	4
Red-poll - - - - -	0	4	0	4	4
Thrush - - - - -	4	4	4	4	4
Blackbird - - - - -	4	4	0	2	2
Robin - - - - -	6	16	12	12	12
Wren - - - - -	0	12	0	4	4
Reed sparrow - - - - -	0	4	0	2	2
Black-cap, or Norfolk } mock nightingale - - - }	14	12	12	14	14

See Phil. Transf. vol. lxiii. pt. ii. art. 31. p. 249, &c.

SONG, *Responsary*. See RESPONSARY.

SONGARI, in *Geography*, a river of Chinese Tartary, which joins the Amur at Saghalien.—Also, a town of Chinese Tartary; 10 miles N.W. of Foe Petouné Hotun.

SONGEONS, a town of France, in the department of the Oise, and chief place of a canton, in the district of Beauvais; 12 miles N.W. of Beauvais. The place contains 1041, and the canton 12,577 inhabitants, on a territory of 205 kilometres, in 29 communes.

SONG-HOA, a town of Corea; 50 miles S.W. of Hoang.

SONGI, a river of Malacca, which runs into the Chinese sea, N. lat. 2° 10'. E. long. 104° 10'.

SONGI *Tanjang*, a town on the west coast of the island of Sumatra. N. lat. 2° 35'. E. long. 97° 10'.

SONGIEU, a town of France, in the department of the Ain; 13 miles N. of Belley.

SONG-KI, a town of China, of the third rank, in Fokien; 40 miles N.N.E. of Kien-nhing.

SONG-KIANG, a city of China, of the first rank, in Kiang-nan, situated in the midst of several rivers or canals, near the sea, so that the Chinese junks approach it in every direction. It carries on a large trade in cotton cloth, which the inhabitants send to different parts of the empire. It has four towns in its jurisdiction; 560 miles S. of Peking. N. lat. 31°. E. long. 120° 44'.

SONG-MEN-CHAN, a small island, near the coast of China, in Tche-kiang. N. lat. 28° 22'. E. long. 121° 21'.

SONGO, or SANGO, a town of Africa, in the kingdom of Mandingo, near the coast of the Gambia.

SONGO. See SANKARI and SOGNO.

SONGOA, an island in the straits of Malacca, about 50 miles in circumference. N. lat. 2° 18'. E. long. 100° 30'.

SONGOO, a small island in the Indian sea, near the coast of Africa. S. lat. 7° 20'.—Also, a town on the east coast of the island of Banca. S. lat. 2° 12'. E. long. 106° 16'.

SONGORA. See SANGORA.

SONG-TCHOUI, a town of China, of the third rank, in Hou-quang; 40 miles N.E. of Ou-tchang.

SONG-TSI, a town of China, of the third rank, in Hou-quang; 27 miles W. of King-tcheou.

SONG-YANG, a town of China, of the third rank, in Tche-kiang; 22 miles W. of Tchu-tcheou.

SONGY-DAVAN, a town on the west coast of Sumatra. N. lat. 1° 18'. E. long. 98° 12'.

SONGY-LAMA, a town on the west coast of Sumatra. S. lat. 3° 40'. E. long. 101° 57'.

SONHO, Songo, or *Sogno*. See SOGNO.

SON-HOIT, a district of Chinese Tartary, in the territory of the Mongols. N. lat. 42° 45'. E. long. 114° 27'.

SONKOE, a town of Bengal; 15 miles W.N.W. of Moorshedabad.

SONMEANY, the principal sea-port in the district of Lus, and province of Mekran, in Persia. It is a small and mean town, and was destroyed in 1809 by the Jouaffimees. It is situated on an elevated bank, at the mouth of the river Pooralee, which forms a bar about a mile from the town, three fathoms deep at low-water, and boats can anchor close to the shore. The inhabitants, with the exception of a few Hindoo merchants, live chiefly by fishing. Fresh water is procured by digging in the sand: and it is necessary that the well be immediately filled up; for if it be suffered to remain open, the water becomes salt.

SONNA, a book, or collection of the Mahometan traditions, or of the sayings and actions of their prophet, which all the orthodox Mussulmen are required to believe. This is a kind of supplement to the Koran, directing the observance of several things omitted in that book, and in sense, as well as design, corresponding to the Mishna of the Jews. See MAHOMETANISM.

The word signifies, in Arabic, the same with *mishna* in the Hebrew, that is, *second law*; or, as the Jews call it, *oral law*.

The adherents to the Sonna are called *Sonnites*, or *Traditionaries*; and as, among the Jews, there is a sect of Caraites, who reject the traditions as fables invented by the rabbins; there are also sectaries among the Mahometans, called *Schiites*, (see the article,) who reject the traditions of the Sonnites, as being only founded on the authority of an apocryphal book, and not derived to them from their legislator.

There is the same enmity between the Sonnites and Schiites, as between the rabbinist Jews and the Caraites. The Schiites reproach the Sonnites, with obtruding the dreams of their doctors for the word of God; and the Sonnites, in their turn, treat the Schiites as heretics, who refuse to admit the divine precepts, and who have corrupted the Koran, &c.

The Sonnites are subdivided into four chief sects, which, notwithstanding some differences as to legal conclusions in their interpretations of the Koran, and matters of practice, are generally acknowledged to be orthodox in radicals or matters of faith, and capable of salvation; and have each of them their several stations or oratories in the temple of Mecca. The founders of these sects are regarded as the great masters of jurisprudence, and are said to have been men of great devotion and self-denial, well versed in the knowledge of those things which belong to a future life, and to man's right conduct in the present state, and directing all their knowledge to the glory of God. This is Al Ghazeli's encomium of them, who thinks it derogatory to their honour, that their names should be used by those who, neglecting to imitate the other virtues which form their character,

character, apply themselves merely to attain their skill, and follow their opinions in matters of legal practice.

The first of these orthodox sects is that of the "Hanefites," so named from their founder, Abu Hanifa al Nomen Ebn Thebet, who was born at Cufa, in the 80th year of the Hegira, and died in the 150th; ending his life in prison, at Bagdad. The reason of his confinement was his refusal to be called "Kadi," or judge; and when he was questioned concerning it, he is said to have replied, "If I speak the truth, I am unfit; but if I tell a lie, a liar is not fit to be a judge." It is reported, that, during his confinement in prison, he read over the Koran no less than 7000 times. An Arabian writer calls the Hanefites "the followers of reason," and those of the three other sects "followers of tradition;" the former being principally guided by their own judgment in their decisions, and the latter adhering more tenaciously to the traditions of Mahomet. This sect formerly obtained chiefly in Irak, but now generally prevails among the Turks and Tartars. The second orthodox sect is that of Malec Ebn Ans, who was born at Medina, in the year of the Hegira 90, 93, 94, or 95; and died there in 177, 178, or 179. This doctor is said to have paid great regard to the traditions of Mahomet. In his last illness, a friend who visited him, and found him in tears, and asking the reason of it, received for answer, "How should I not weep? and who has greater reason to weep than I? Would to God that for every question decided by me according to my opinion, I had received so many stripes! then would my account be more easy. Would to God I had never given any decision of my own!" The doctrine of Malec is chiefly favoured in Barbary, and other parts of Africa. The third orthodox sect was denominated "Shafeites." (See the article.) The founder of the fourth sect was Ahmed Ebn Hanbal. See HANBAL. Sale's Koran, Int.

SONNEBECK, in *Geography*, a town of France, in the department of the Lys; 5 miles N.E. of Ypres.

SONNEBERG, a town of Bohemia, in the circle of Saatz; 6 miles W. of Commotan.—Also, a town of Germany, in the principality of Coburg; 10 miles N.N.E. of Coburg. N. lat. 50° 23'. E. long. 11° 13'.—Also, a town of Austria; 12 miles S.S.W. of Laab. N. lat. 48° 29'. E. long. 16° 2'.—Also, a citadel of Austria, which gives name to a county vested in the house of Austria; 23 miles S. of Bregentz.

SONNEBORN, a town of Prussia, in the province of Oberland; 5 miles S. of Morungen.

SONNEBURG, a town of the Middle Mark of Brandenburg, on a small river, which runs into the Warta; in which is a commandery of the knights of Malta. The grand-master may create as many knights as he pleases, nor are Lutherans excluded, who are permitted to marry. The elector of Brandenburg is the grand-master of the order; 10 miles E.S.E. of Cultrin. N. lat. 52° 37'. E. long. 14° 58'.

SONNECQUE, a river of Brabant, which runs into the Senne, 5 miles above Halle.

SONNEG, a town of the duchy of Carinthia; 2 miles S. of Eberndorff.

SONNEN KOGEL, a mountain of Austria; 8 miles S. of Steyr.

SONNENBERG, a town of Germany, in the principality of Nassau Saarbruck Uffingen; 2 miles N.E. of Wisbaden.—Also, a town of Silesia, in the principality of Grotkau; 6 miles S.E. of Grotkau.—Also, a town of Prussia, in the province of Bartenland; 12 miles S.E. of

Bartenstein.—Also, a town of Prussia, in the province of Ermeland; 16 miles E.N.E. of Elbing.

SONNENBURG, a town of Brandenburg, in the New Mark, on the Lenza; 7 miles E. of Cultrin. N. lat. 52° 37'. E. long. 14° 58'.

SONNENSTEIN, a fortress of Saxony, in the margraviate of Meillen, near Pirna.

SONNERATIA, in *Botany*, was so named by the younger Linnæus, in honour of a distinguished French traveller and naturalist, M. Sonnerat, who published, in 1776, a Voyage to New Guinea, in one volume. 4to.; and in 1782, a Voyage to the East Indies and China, in two similar volumes. Both works are adorned with a multitude of engravings. They do honour to the author's character, as well as to his information. The latter publication is peculiarly instructive and correct, on the subject of Hindoo mythology, and has been made much use of by various succeeding writers. Botany does not make a prominent part of M. Sonnerat's performances; but he has described and figured several new or rare plants, particularly adverting to important articles of trade or medicine whose history was previously obscure, in his Voyages, and he is also the author of some expressly botanical treatises, of similar aim, which have been given to the world in periodical publications. He died, a short time since, at an advanced age, having just before paid a visit to England.—Linn. Suppl. 38. Schreb. Gen. 337. Willd. Sp. Pl. v. 2. 999. Mart. Mill. Dict. v. 4. Juss. 325. Lamarek Illustr. t. 420. (Aubletia; Gært. t. 78.)—Class and order, *Icosandria Monogynia*. Nat. Ord. *Myrti*, Juss.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, coriaceous, somewhat bell-shaped at the base, with a tumid internal border; the limb in six or four ovate, acute, spreading, flat, permanent segments. *Cor.* Petals sometimes six, awl-shaped, spreading, inserted into the internal rim of the calyx, and about the same length; in some cases wanting. *Stam.* Filaments numerous, flattened, inserted likewise into the rim of the calyx, as long or longer than its segments; anthers roundish. *Pist.* Germen superior, globose, style thread-shaped, about the length of the stamens; stigma capitate. *Peric.* Berry large, globose, pointed, smooth, seated on the permanent calyx, of many cells, full of vesicular pulp. *Seeds* numerous, oblong, curved, gibbous and corrugated.

Ess. Ch. Calyx in four or six segments, coriaceous, inferior, permanent. Petals awl-shaped, or none. Berry of many cells. *Seeds* numerous, gibbous.

Obs. This genus is somewhat like a *Punica*, with its fruit turned out of the calyx. The younger Linnæus seems to have studied very superficially the only species which fell in his way, never perceiving it to be an old plant of his father's, described and figured by Rumphius.

1. *S. acida*. Red-flowered Sonneratia. Linn. Suppl. 252. Willd. n. 1. (Rhizophora caecolaris; Linn. Sp. Pl. 635. Aubletia caecolaris; Gært. v. 1. 379, excluding the synonym of Rumphius. Mangium caecolare rubrum; Rumph. Amboin. v. 3. 112. t. 74. Pagapate; Sonner. Nouv. Guin. 16. t. 10, 11.)—Flowers in six segments; with six petals. Leaves elliptic-oblong. Branches quadrangular.—Native of the muddy banks of large rivers in the Molucca islands; often planted about houses for the sake of its fruit. Sonnerat found it in moist parts of New Guinea. We have a specimen, gathered by Dr. Buchanan in Bengal, where, as he informs us, the natives know this plant by the name of *Duabanga*. The Malays call it *Brappat*, according to Rumphius, who describes it as a large tree, flowering in

October. The *branches*, as he justly observes, are square, not round. The heart of the *wood* is hard and durable. *Leaves* opposite, on very short stalks, elliptic-oblong, obtuse, with a small point, entire, somewhat succulent, a span long, smooth, with one rib, and numerous transverse veins; their under side glaucous. *Flowers* terminal, solitary, of a beautiful red. *Fruit* green, acid, smelling like rotten cheese, falling out of the *calyx* when quite ripe. The Malays, &c. eat it, as well as the young leaves, with fish and other food. The beautiful half-expanded *flowers* are worn as ornaments for the head, and are often imitated in gold. Rumphius says it is usual to depress the stamens with two little pegs, forced cross-wise through the pistil.

2. *S. alba*. White-flowered Sonneratia. (Mangium caseolare album; Rumph. Amboin. v. 3. 111. t. 73.)—*Flowers* in six, or more, segments, without petals? *Leaves* elliptical or roundish. *Branches* round.—Native of stony or rocky plains, overflowed by the tide, on the sea shore of the Molucca and neighbouring islands, flowering in August and September. Rumphius describes this as a large, thick and rugged tree, like an oak, with spreading and curved branches, commonly laden with various parasitical plants. The *branches* are round. *Leaves* smooth, brittle and succulent, with hardly any visible veins, and of a rounder broader shape than the foregoing. *Flowers* two or three together at the end of each branch. *Calyx* green, in six, seven or eight divisions. No mention is made of any *petals*. *Stamens* long, white, with brown *anthers*. *Style* very long, with a green *stigma*. *Fruit* depressed, as broad as the hand, internally dry, white, and granular, with an astringent, and slightly acid flavour, but no smell. It bursts at length into several portions, but does not fall off like the former, nor is it so generally eaten, except when dressed with fish. Rumphius so clearly distinguishes this species, which Gærtner mistook for the former, and Linnæus confounded therewith under his *Rhizophora caseolaris*, that though we have seen no specimen, we have ventured to describe it. What those horn-shaped excrescences are, which occupy the soil at some distance from the base of this tree, from a span to a foot in length, and of a corky substance, as described by Rumphius, we can offer no conjecture.

3. *S. apetala*. Small-flowered Sonneratia. Buchanan in Symes's Embassy to Ava, octavo, v. 3. 313. t. 25.—*Flowers* in four segments; without petals. *Leaves* ovato-lanceolate. *Branches* round, pendulous.—Native of the moist inundated sea-shores of the kingdom of Ava, near Rangoon, flowering in May. We have specimens communicated by Dr. Roxburgh to lord Valentia. This is described as a most beautiful tree, resembling our Weeping Willow, but taller, with scattered, pendulous, smooth, round, slender branches. *Leaves* few, opposite, stalked, ovato-lanceolate, entire, smooth, rather fleshy, about three inches long, mostly blunt, a little unequal at the base, hardly an inch broad. *Flowers* axillary and terminal, stalked, drooping, greenish, about an inch in diameter, with white stamens, the length of the *calyx*, but no *petals*. *Fruit* orbicular, depressed, of eight cells, with numerous angular seeds. The *stigma* is remarkable for its great size, and conical figure, hollow underneath, like a sort of cap. The want of *petals* in this species induces us the more readily to believe, that they may also be wanting in the last, and that the accurate Rumphius has not merely by accident omitted to mention them.

SONNERSKARET, in *Geography*, a small island on the E. side of the gulf of Bothnia. N. lat. 63° 25'. E. long. 21° 32'.

SONNET, SONETTO, in *Poetry*, a kind of composi-

tion properly contained in fourteen verses; viz. two stanzas, or measures, of four verses each, and two of three; the eight first verses being all in two rhymes.

The sonnet is of Italian origin, and Petrarch is allowed to be the father of it; it is held the most difficult and artful of all poetical compositions, as requiring the utmost accuracy and exactness. It is to end with some pretty ingenious thought: the close must be particularly beautiful, or the sonnet is defective.

In Malherb, and some other French poets, we meet with sonnets, where the two first stanzas are not in the same rhyme; but they are held irregular; and, in effect, great part of the merit of these pieces consists in a scrupulous observance of the rules.

Ronsard, Malherb, Maynard, and Gombaut, have composed abundance of sonnets; but, among two or three thousand, there are scarcely two or three worth much.

Pasquier observes, that Du Bellai was the first who introduced sonnets into France. But Du Bellai himself says, that Merlin de S. Gelais first converted the Italian sonnets into French.

Of twenty-three sonnets which were written by our great poet Milton, that addressed to Henry Laws is one of the best; and yet this shews how difficult and unnatural the construction of this species of poem is in the English language; whereas, from the great number of similar terminations in the Italian tongue, and the success of Petrarch, it has long been the favourite measure of Italy for short compositions. However, Muratori thinks it extremely difficult for his countrymen to make a good sonnet; and he compares this kind of poem to the bed of Procrustes, where the legs of those that were too short were stretched, and those too long were cut to the size of the bed.

Antonio a Tempo, a civilian at Padua, in his Treatise on Poetry, 1332, distinguishes sixteen different kinds of sonnet. Burney's Hist. Music, vol. ii. p. 324.

SONNEWALDE, in *Geography*, a town of Saxony; 10 miles S. of Luckau. N. lat. 51° 40'. E. long. 13° 38'.

SONNINO, a town of Campagna di Roma; 6 miles N. of Terracina.

SONNO, a town of Japan, in the island of Nippon; 18 miles N.W. of Iwata.

SONOKI, a town of Mingrelia; 45 miles S.E. of Anarghia.

SONORA, or SENORA, a province of New Spain, situated between 35° and 27° N. lat. and 110° and 117° W. long.; bounded N. by New Mexico, W. by California, S. by Sinaloa and the gulf, and E. by Biscay and New Mexico. Its greatest length from N. to S. is about 420 miles, and its breadth from E. to W. 380 miles. The air is dry and pure, and the climate generally healthy, though near the gulf the ground is marshy, and it is, in some of the districts, insalubrious. Sonora abounds in rich gold and silver-mines, particularly the former. Like Biscay, it is destitute of timber, but it has some rich soil near the gulf. Its rivers are the Rio de Pascension, which enters the gulf of California about N. lat. 31°, and the Rio Yaqui, which discharges itself into the same gulf at Guyamas, at N. lat. 28°. Its animals are the deer, cabrie, and bear, and large lizards, which are tamed by the inhabitants, and trained to catch mice. The population of Sonora may be estimated at 200,000 souls, consisting of Spaniards, Creoles, Metifs, and Indians. The capital of Sonora is Arispaa, situated in N. lat. 21° and W. long. 111°, near the head of the river Yaqui; celebrated for the urbanity and hospitality of its inhabitants,

habitants, and for the large quantity of gold table utensils used in their houses; and having a population of 3400 persons. The next cities in respect of magnitude are Sonora, S., and Terenate, N. of the capital. Sonora trades with New Mexico and Biscay for the productions of those different provinces, and with old Mexico, both by land and sea, through the gulf of California. It is famous for its cheese, horses, and sheep. The governor is a brigadier-general, and his salary is 7000 dollars, in addition to his pay in the line. The regular military force of this province consists of 900 dragoons, and 200 infantry, the latter being Indians called Opejas, and reckoned the best soldiers in New Spain. The professed religion is the Catholic, and it belongs to the diocese of the bishop of Durango. The seat of government is at Chihuahua.

SONORYA, a town of Hindoostan, in Benares; 10 miles S. of Merzapour.

SONS HARMONIQUES, or fluted sounds, a singular kind of sound produced on the violin, tenor, and violoncello, by touching the string slightly in its aliquot parts and harmonic divisions, without pressing the finger on the finger-board; by which means, that part of the string sounds, which is above the hand next to the nut, not the part touched by the bow. These sounds are very different in quality of tone from those which would be produced, if the finger were pressed down. As to the pitch of tone, the harmonics will give the fifth, when the third would be produced by the usual means; the third, when the sixth is expected, &c. The quality of tone acquired by this means is so much more sweet than the common tones of the instrument, that the French have entitled them *notes flutées*, fluted notes. Rousseau says, that to form an accurate idea of these sounds, it was necessary to hear Mondonville produce them on his violin, and Bernard on his violoncello, who could form a regular scale of these sweet tones, which very much astonished those who did not know the theory. But we have heard Salomon perform this feat, this trick of youth, with a dexterity and taste unknown to Mondonville.

As the principle on which this theory is founded depends on transferring the tone, produced by the bow, to that part of the string next the nut, instead of that next the bridge, of which the bow prevents the vibration, the long division of the string, when touched slightly by the finger, seems to produce the highest note; and *é contra*.

We shall give, in the *Musical Plates*, a table of harmonic sounds, which will facilitate the practice of this seemingly eccentric scale. The first line, or staff, will indicate the sounds which would be produced in the common way; and the second line, the correspondent fluted note, when the string is touched harmonically. All the sounds of the trumpet marine are harmonics, which renders it difficult to produce certain sounds upon that instrument. See NOISE.

SONSBECK, in *Geography*, a town of the duchy of Cleves; 11 miles S.S.E. of Cleves.

SONSECA, a town of Spain, in New Castile; 8 miles S. of Toledo.

SONSINO. See SONCINO.

SONSONATE. See *La TRINIDAD*.

SONTAG, a town of the duchy of Stiria; 3 miles N.W. of Fridau.

SONTAGBERG, a town of Austria, in which is a cloister of Benedictines; 5 miles N. of Bavarian Waidhoven.

SONTAGE, in our *Old Writers*, a tax of forty shillings laid upon every knight's fee, according to Stow, p. 284.

SONTHEIM, in *Geography*, a town of Germany, in

the lordship of Limburg; 15 miles S.E. of Hall in Swabia.

SONTHEIM, *Maine*, a town of the duchy of Wurzburg, on the Maine; 3 miles N. of Kitzingen.

SONTHOFEN, or SUNTHOFEN, a town of Bavaria, in the bishopric of Augsburg; 56 miles S. of Augsburg.

SONTHONNAX *de la Montagne*, a town of France, in the department of the Ain; 6 miles N.W. of Nantua.

SONTRA, a town of Germany, in the principality of Hesse Rhinens, on the Wohra; 28 miles S. of Cassel. N. lat. 51° 5'. E. long. 9° 58'.

SONVICO, a town of Italy; 5 miles N. of Lugano.

SONUS, or NUMADUS, in *Ancient Geography*, a river of India, on this side of the Ganges, which had its source in the mountains, ran towards the east, and bending its course towards the north-east, discharged itself into the Ganges, a little below Jomanas, after a course of about 200 leagues. M. d'Anville supposes that this river is the Audomatis of Arrian; but as this river had its rise among the Mondiadini, and ran into the Ganges, it could not be the same with the Sonus.

SONWARY, in *Geography*, a town of Hindoostan, in Guzerat; 21 miles S. of Surat.

SONZAY, a town of France, in the department of the Indre and Loire; 12 miles N. of Tours.

SOO, a town of Japan, in the island of Ximo; 25 miles N.W. of Uxumi.

SOOBARUM, a town of Hindoostan, in the circle of Cicacole; 10 miles N.W. of Visigapatam.

SOOBKA, a town of Bengal; 13 miles S. of Bogli-pour.

SOOBOO, a town of Africa, in Bambarra; 10 miles W. of Sego.

SOOBRUDOOKI, a town of Africa, in Bondou; 20 miles S.W. of Fatteconda.

SOO-CHOO. See SOU-TCHEOU.

SOOCOO, in *Commerce*, a money of account at Bencoolen; 4 soocoos being = a dollar = 32 fattalies, or fattellers: this dollar is reckoned at 5s. sterling.

SOODEREH, in *Geography*, a town of Hindoostan, in Lahore; 15 miles N.N.E. of Ameenabad.

SOOE, a town of Hindoostan, in Guzerat; 37 miles N.N.E. of Radunpour.

SOOHA, a town of Africa, in Bambarra, on the river Niger. N. lat. 13° 10'. W. long. 4° 52'.

SOOHAGEE, a town of Hindoostan, in Boggilcund; 30 miles N.N.E. of Rewah.

SOOINS, a name given in the North to a kind of rural food, that has been found very beneficial in the scurvy. This food is prepared by putting some oatmeal into a wooden vessel, and pouring hot water upon it, and continuing the infusion till the liquor begins to taste sourish, *i. e.* till a fermentation comes on, which in a place moderately warm may be in the space of two days. The water is then poured off from the grounds, and boiled down to the consistence of a jelly.

SOOKA, in *Geography*, a town of Bengal; 42 miles W. of Silhet.

SOOKANG, a town of Africa, in Fooladoo. N. lat. 13° 35'. W. long. 8° 5'.

SOOKAPOORA, a kingdom of Japan.

SOOKJURAH, a town of Bengal; 33 miles W. of Nagore.

SOOKSOR, a town of Bengal; 6 miles N. of Calcutta.

SOOLARAM, a town of Hindoostan, in the circle of Ellore.

SOOLOO,

SOOLOO, one of the Philippine islands, in the East Indian sea, about 30 miles long and 10 broad, and containing 60,000 inhabitants, who are Malays, governed by a king or sultan, with an aristocracy of about fifteen nobles, named "datoos," who form the greatest part of the legislature, whose title is hereditary to the eldest son, and who sit in council with the sultan. This island enjoys a perpetual summer, and produces a great variety of fruit: it abounds with the tree called teak. Many Chinese live on the island, and carry on great trade, sending to Canton black and white swallows, wax, pearls, teepye, or pearl oyster-shells, bird's-nests, tortoise-shell, sago, rattans, sandal, and various dyeing woods, cinnamon, or cassia, &c. At Sooloo, and many neighbouring islands, the pearl fishery has been carried on for ages, and is the principal source of their wealth. The dominions of Sooloo extend over the principal part of the archipelago of islands between Borneo and Mindanao, called the Sooloo Archipelago, and even on the north coast of the former island. Their religion is Mahometan, but in their morals they are faithless and cruel. The English East India company have an agent in this island. On the neighbouring sea are some excellent pearl fisheries; and abundance of edible bird-nests are found, especially in a small island, or rock, to the S.W. of Sooloo; but the principal production is sago. The situation is between Borneo and Mindanao, 42 miles S.W. from the latter. N. lat. 6°. E. long. 119°.

SOOLOO Archipelago, a part of the Eastern Indian sea, covered with a great number of small islands, extending from the S.W. coast of Mindanao to the N.E. coast of Borneo.

SOOMA, a town of Japan, in the island of Nippon; 45 miles E. of Jedo.

SOOMGONG, a town of Hindoostan, in Goondwana; 10 miles S. of Nagpour.

SOOMOONANG, a lofty range of mountains, which forms the boundary of Thibet on the south, and divides it from Bootan.

SOONABATTY, a town of Hindoostan, in Bahar; 40 miles E. of Doefa.

SOONAJURA, a town of Hindoostan, in Bengal; 50 miles W. of Silhet.

SOONAL, a town of Hindoostan, in the country of Malwa, of considerable extent, of a square form, and inclosed within a stone wall. Two wide streets cross one another, at right angles, in the middle of the town, which is the "Chowk." There are 32 villages in this pergunnah.

SOONAM, or SUNNAM, a town of Hindoostan, in the country of Delhi; 136 miles W.N.W. of Delhi. N. lat. 29° 57'. E. long. 75° 31'.

SOONAMOOKY, a town of Bengal; 13 miles N. of Bissunpour. N. lat. 23° 18'. E. long. 87° 33'.

SOONDA, a small country of Hindoostan, near the west coast, between Canara and Concan, about 40 miles from north to south, and 30 from east to west. After the death of Tippoo, sultan of Myfore, this country was assigned to the Mahrattas.

SOONGARES, a nation of Russia, which, at the separation of the Mongolian monarchy, formed one flock with the Derbetans, but afterwards parted, under two discordant brothers of their princely family. It was this horde which, in the 17th and 18th centuries, reduced to their subjection a great part of the other Kalmuck races, particularly the Khofshot, Derbet, and Kho-it; and waged bloody wars with the Mongoles, as well as with the Chinese empire itself, but which ended in their total subjugation and

dispersion. Previously to this unhappy period, they, together with the Derbets, numbered upwards of 50,000 bows, or fighting men, and passed in modern times for the bravest, richest, and most powerful horde. Their seat was formerly about the Balkhash lake, and its rivers Tschuy and Ily; and their most flourishing period was between the years 1696 and 1746. The towns of the eastern Bucharia and the great Kirghise horde were, about this time, tributary to them. They conquered Budala, the capital of the Dalai-lama, and raised contests in Siberia, where they made tributary some nations belonging to Russia. On the death of their khan Galdan Zeren, a dissolution of the horde ensued, occasioned by disputes concerning the succession; when the Torgots, the Khofshots, and Derbets, separated from it. Many of the Soongarians dispersed themselves in the interior parts of Asia, and quite into the Ubeck towns; some thousands of them fled into Siberia; when the generality accommodated themselves to the Chinese sovereignty: and from their own statements it appears, that scarcely 20,000 families of them and of the Derbetan nation are now remaining. The number of the Soongares, who at that time (1758) took refuge in Russia, amounted to about 20,000 persons. They were united with the Volgaic Kalmucks, but for the most part returned with them, in the year 1770, again into the Soongarey. Tooke's View of the Russ. Emp. vol. i.

SOONGEY PESANG Bay, a bay on the west coast of Sumatra. S. lat. 0° 57'. E. long. 99° 50'.

SOONKY, a town of Hindoostan, in Bahar; 15 miles W.N.W. of Arrah.

SOONWALLA, a town of Hindoostan, in Berar; 17 miles W. of Akoat.

SOONYGONG, a town of Hindoostan, in Goondwana; 60 miles N. of Ramteak.

SOOP. See SOUP.

SOOPA, in *Geography*, a town of Hindoostan, in Dow-latabad; 27 miles E. of Poorunder.

SOOPOUR, a town of Napaul, on the borders of Bahar; 120 miles N. of Patua.—Also, a town of Bengal; 30 miles S.E. of Nagore. N. lat. 23° 38'. E. long. 87° 48'.—Also, a town of Bengal; 45 miles N.W. of Midnapour.—Also, a town of Hindoostan; 5 miles N.W. of Benares.—Also, a town of Hindoostan, in Oude; 46 miles N.N.E. of Gooracpour. N. lat. 27° 20'. E. long. 84° 13'.

SOOPSUNDY, a town of Hindoostan, in the Carnatic; 10 miles S.S.E. of Tanjore.

SOOR, or SHOOR, a name given to the river Indus, between Attock and Moultan.

SOOR. See TSOR.

SOORANGUR, a town of Hindoostan, in the Orissa country, near the river Mahanada; the burial-place of an Englishman of the name of Elliot, who died on his way from Calcutta to Nagpour in the year 1778. Mr. Hallings caused a monument to be erected on the spot to his memory; 200 miles E. of Nagpour.

SOORAPATEE, a kingdom of the island of Java, on the south coast, east of Panaraga.

SOORAPETTA, a town of Hindoostan, in Golconda; 33 miles S. of Combamet.

SOORATPOUR, a town of Hindoostan, in Bahar; 10 miles N.N.E. of Arrah.

SOOREAH, a town of Hindoostan, in the circar of Ruttunpour; 28 miles S.S.E. of Ruttunpour.

SOORJEW, a name given to the Dewah, in Thibet.

SOORMA, a river of Asia, which rises in Meckley, and runs into the Burrampooter, near Sunerampour, in Bengal.

SOOROOT, an island in the Eastern Indian sea, about 25 miles in circumference. N. lat. $2^{\circ} 45'$. E. long. $108^{\circ} 36'$.

SOORORE, a circar of Bengal, bounded on the north, east, and south, by Cossimpour and Dinagepour; and on the west by Rajemal; about ten miles long, and from five to eight broad. Bydell seems the chief town.

SOORWALL, a town of Hindoostan, in Bundelcund; 35 miles W. of Allahabad.

SOORY, a town of Bengal; 7 miles E. of Nagore. N. lat. $23^{\circ} 55'$. E. long. $87^{\circ} 38'$.

SOOSELA, a town of Africa, in Kullo. N. lat. $12^{\circ} 21'$. W. long. $8^{\circ} 40'$.

SOOSNEER, a pretty large town of Hindoostan, in Malwa, belonging to Sindiah. See **OUGEIN**.

SOOSOOHOONAM, or **SOESOEHOONAM**, often called *Soefoehoonam Materam*, from the place of the residence of the emperor of Java, a kingdom or empire, being the fourth, of the island of Java. This empire formerly comprehended the greatest part of the island; that of "Cheribon" formed a part of it, and it was then very powerful; but since the Dutch established themselves there, it has lost much of its importance. Nevertheless it remained undivided till about the middle of the last century, when the emperor found himself so much embarrassed, in consequence of the rebellion of Manko Boeni, a prince of the blood, that he made a cession of his territories to the Company; who, in return, granted him half of it as their vassal, and promised him their protection; engaging, at the same time, never to make any one emperor of Java, who was not a prince of the imperial family. The empire being thus divided, the other half was, in the same manner, given to Manko Boeni, as the Company's vassal, under the title of sultan, with the like promise of protection, and the like engagement never to nominate any other than princes of his family, as successors to his dignity. This other half constitutes the fifth empire of Java. The capital of Soefoehoonam is Jolo.

SOOSWARGUR, a town of Hindoostan, in Sumbulpour; 32 miles W. of Sumbulpour.

SOOT, an earthy volatile matter, arising from wood, coals, and other fuel, along with the smoke, by the action of fire; or rather, it is the smoke itself, fixed and detained on the sides of the chimney.

Soot is a collection of substances formed by the matter in the flame of inflammable bodies, but which have escaped perfect combustion, from not having sufficient contact with the vital air. Hence it is that the soot may be burned over again, and hence likewise it is that when the combustion is very rapid and effectual, there is no perceptible smoke, because all the inflammable matter is then destroyed; as in the cylinder lamps, violent fires, &c. This matter is always of a black colour, more or less brownish, which colour it acquires from an oil that is burnt, and half reduced to the state of coal. Its different qualities and appearances are owing to the nature of the inflammable substances which produce it, and the different manner in which they are burnt.

Chimney soot is a compound of black carbonaceous matter with a considerable quantity of carbonated ammonia, and probably some other ammoniacal salts; and hence it gives a strong pungent smell of this alkali, when rubbed with quicklime. The analysis of soot exhibits an oil, which may be extracted by distillation; a resin, which may be taken up by alcohol, and which arises either from the imperfect alteration of the resin of the vegetable, or the combination of vital air with the volatile oil. It likewise affords an oil, which is often formed by the de-

composition of mucus; and it is this acid, of great utility in the arts, for which the academy of Stockholm have described a furnace proper for collecting it. Soot likewise affords volatile salts, such as the carbonate of ammonia, and others. A slight portion of fibrous matter is likewise volatilized by the force of the fire, and it is again found in the foot.

Soot is mostly formed from the combustion or burning of common or pit-coal, and in general contains some portion of matters derived from animal substances; it is consequently powerful, when applied as a manure. In the trials of sir Humphrey Davy, it was found to afford ammoniacal salts by distillation, and to yield a brown extractive matter, of a bitter taste, by means of hot water. It is likewise said to contain an empyreumatic oil, but that its great basis is charcoal, in a state in which it is capable of being rendered soluble by the action of oxygen and water.

The soot which is formed either from vegetables or from coal, is good both for corn and grass, especially on cold moist grounds, or lands apt to be over-run with moss. Many have found their account in sowing it early over their green wheat and barley crops; but Mr. Ellis says, neither of them ought to be sooted after the 25th of April, because the wheat, and generally the barley, have then done gathering and branching, and are upon the spindle. He likewise thinks it proper to be sown over young turnips, just after they have appeared. But care should always be taken not to sow it too thick, lest its hot nature should hurt the plants. Mr. Worlidge seems to think wood-soot the best; but Mr. Mortimer prefers that which is made from sea-coal, of which about 40 bushels are commonly allowed to an acre; though some grounds will require more: to which he adds, that it produces a very fine sweet grass, and destroys worms and weeds; and that it ought not to be sown upon wheat till Candlemas, because the long cold rains and snows are apt to wash it in too soon; nor is it safe to lay it on later, lest a drought succeed, and burn it up. See **MANURE** and **TOP-DRESSINGS**.

However, Mr. Donaldson observes, that this useful manure can be obtained in considerable quantities only from great cities, or large manufacturing towns. The price in London, whence great quantities are carried to the adjacent districts, is eight-pence the bushel. The ordinary allowance is from 25 to 35 bushels an acre. Soot is used in many parts of England, as Middlesex, Buckingham, Gloucester, Wilts, Lancashire, Yorkshire, &c. The mode of application is chiefly as top-dressings for young clover, sainfoin, and old worn-out meadows. The best season for laying it on is in February or March. It is carefully spread over the field with the hand, and always succeeds best, if rain immediately ensues. But Mr. Marshall recommends its being sown before rain, when a shower washes it in, and will be of obvious service; but that if it lie on the surface long without rain, there will be no benefit derived from it. A rich soil wants no soot, but a soil much out of heart wants 40 or 50 bushels. In his Rural Economy of Norfolk, he says, that the time of sowing it over the land is considered as very material. If it be sown early, and the frost catch it, its strength is thereby lowered; if late, and no rain falls to wash it in, it is thought to be rather injurious than beneficial to the crop of wheat. And it is not, in any case, found of much, if any, service to the succeeding crop of barley.

The method of sowing it is extremely simple; and, in the only instance he saw, the sowing of soot practised there, was very complete. A favourable opportunity being embraced, when the wind blew gently, and in the direction, or nearly

in the same direction, as the lands or ridges lie; the same waggon which brought it from Norwich, and which, until the opportunity offered, had stood safe under cover, was drawn in a furrow against the wind; while a man, standing on the outside of the waggon, spread the soot, with a shovel, several yards wide on either side of him; the height of his situation at once enabling him to spread it wide and even. As he reached the windward end of the lands, the team wheeled round under the hedges, and took a fresh width. The quantity set on was forty bushels an acre in this case.

Mr. Young, however, remarks, that, in general, thirty bushels are used for a complete dressing; that is, when dung or some other manure has not been previously applied to the same crop, which is very frequently the practice, and the quantity of top-dressing is then diminished to about one-half of a complete dressing. Of soot, a complete dressing, as above, costs from 30s. to 36s. per acre. Soot is found to answer best on wheat in April. It likewise succeeds on pease or clover in the same month, and has a good effect sown with barley, in the beginning of April, and harrowed in. A slight dressing of soot is used at any time in the spring, when grubs or worms appear to injure the young corn. The worms frequently make great havoc, by drawing the blades of young corn after them into their holes: this soot prevents best: soot thinly distributed on newly sown turnips, just before they come up, prevents the fly or grub from injuring them, provided no rain falls to wash it into the soil. Soot answers best on light, dry, chalky soils, and in moderately wet seasons. It does little good on strong or wet land, or in very dry seasons, unless sown earlier than usual. The London soot from coals is rarely bought unmixed with cork-dust, coal-ashes, or sweepings of the streets; yet, even in this adulterated state, it is found to answer much better than real country soot from wood.

And it is remarked, in the Agricultural Survey of Hertfordshire, that about Stevenage they spread from 20 to 40 bushels an acre, bringing it from London: it costs 8d., and the carriage 3d., in all 11d. per bushel. And Mr. Clarke of Sandridgebury, spreads from 35 to 40 bushels an acre on wheat. But about Beachwood they sow from 30 to 40 bushels on wheat, in February or March, bought at 1s. a bushel at London, and bring 160 bushels in a waggon with four horses. Around Hitchin, 40 bushels are sown on wheat. And a good deal is used at Watford, at the rate of 40 bushels an acre. Also, about Barkway they have a very high opinion of it; 50 bushels an acre, brought 30 miles from London, are seen on wheat to an inch. And it is stated, in addition, that the practice is universal through this country; inasmuch, that the question is, whether there is a parish in it in which some men are not in the habit of using this manure from London.

On cabbage crops that have been sown, it has been found that if, as soon as the plants appear distinctly above the ground, a furge of soot be drilled upon them, to the amount of from 10 to 12 bushels the acre, it affords much security against the fly. And it has been suggested that this business may be cheaply and conveniently executed by a hopper and round of cups, similar to Cook's, but larger, fixed to a frame similar to that of the Northumberland drill. When employed for preventing the fly in drilled turnips, it should be sprinkled along the rows, from a scuttle, by the hand, or some such mean, in the proportion of about twenty bushels the acre.

But in respect to the application of this sort of substance to land, it is remarked by Mr. Kiddle, in the fourth volume of Communications to the Board of Agriculture, that

all manures that are laid on the surface of land cannot be laid on too early in the season. Soot, for instance, is always recommended to be sown on wheats or clovers, and grass-lands, in the month of February, from a notion, that if sown sooner, they would exhaust themselves too soon. This, he thinks, absurd reasoning. No manure can be of any service to the crop, which it is meant to advantage, until it reaches the roots: and what contributes more to save it than the winter rains, and the dissolving of the snow? He has, in consequence, always sown the soot for wheat and clover, when he has been able to procure it, in the month of November or December, and always with satisfaction to himself. He last year sowed with soot an inclosure of wheat of eight acres, part of which was sown in the beginning of December, before the frost set in, and a heavy rain succeeded the sowing; on the remaining parts, owing to his not being able to procure more soot at that time, the sowing was postponed until after the frost was gone, in the month of February. The quantity sown on an acre, in both instances, was equal; but the superiority of the crop of wheat, where it was sown early, might be discerned by the eye. He had the curiosity to have it thrashed separately, and found its increase beyond the other considerable. If he could procure soot at the time of sowing wheat, he should be under no apprehension of its answering then, if the land was worked for the wheat. Some years since, having bought a small quantity of soot immediately after harvest, he had the desire to try its effects on the crop at that early season, and having a pea-stubble which had been ploughed twice, and was designed for wheat, after sowing as much of the land as he had soot for with wheat, he then had the soot sown, and ploughed both in together. He owns he was anxious to see the success of his experiment, as it was a novel one, as were his neighbours also who had seen it done. The remainder of the land was sown with soot, as he was able to procure it. The wheat, where the soot was sown with it, kept the lead during the first months: this he did not wonder at, but expected it from its forcing quality; but he was very much pleased to see it continue to do so during the remainder of the season, and at harvest the superiority in favour of it was easily to be seen.

Soot, in some districts, as where the soil is rather inclining to be strong and heavy, is far from being found a durable manure, though it commonly produces very strong crops for the first year. And it is in other places more commonly applied over the grass-lands than the tillage crops, being supposed more useful and proper in such a manner of application. But it is not improbable but that it is a sort of manure that may in general be the best fitted to be employed in its dry state by being thrown into the ground at the same time with the seed, somewhat in the manner of powdered rape-cake, having the advantage of requiring no sort of preparation when used in this way.

Some suppose that 20 bushels of soot to the acre are nearly equal to 50 of the ashes of either coals, wood, or peat. And the writer of the Middlesex corrected Agricultural Report remarks, that the smoke, consisting of the lightest particles of soot and coal, raised by the force of the ascending current of rarefied air arising from 300,000 fires in the metropolis and its vicinity, is daily deposited on the surrounding country; where the next rain washes it into the soil, and it promotes vegetation and the fertility of the land to a considerable degree.

The dyers make a considerable use of soot, for a kind of dun-colour; which, it is true, has no agreeable smell; but, in return, it has the property of saving clothes, and other stuffs, from moths.

Carbonated ammonia is extracted from it in the large way in several manufactories of this salt.

Soot of Frankincense, is the smallest and finest part of the incense called olibanum, or male incense; burnt after the manner of rosin, to make lamp-black.

Soot, Wood, was formerly regarded as a good medicine in many cases, but the principles upon which it acted as such were never well understood, till Boerhaave gave a regular analysis of it. The directions he gives for the process are these.

Choose the blackest and driest wood-foot from the chimney of an oven, where nothing is baked but bread, and nothing burnt but vegetables; gather this in a dry day, and fill with it a glass retort almost up to the neck; clean the neck of the retort, and luting on a receiver, give a fire of 150°, and keep it up equally, a large quantity of transparent water will come over with considerable violence. When no more water will come over, cleanse the receiver, and raising the fire to a little above 200°, there will then come over a whitish fat liquor; this also comes over with great violence, and the fire must be gradually increased, till no more of this will come. Change the receiver, and raise the fire to a yet greater degree, and a yellow, copious, volatile salt will come over, and stick all over the sides of the new receiver. When no more of this salt will arise, increase the fire to the utmost that sand can give, and with a heat of suppression there will arise a black thick oil; when this is all come over, and the vessels cooled, there will be found in the neck of the retort a salt, which could be raised no higher, even by that violent fire; and in the bottom of the retort there remains a black feculent matter, the upper surface of which is covered with a white saline crust, which, both in figure, colour, and the structure of its stræ, resembles the common sal ammoniac. If the milky liquor be rectified, it affords a very penetrating volatile spirit, and some sharp volatile salt.

Here we are taught what the agitation of an open fire can move, change, expel, and drive through the air by burning; first in the form of smoke, then of flame, and lastly of exhalation, and how high it is able to carry them; for a chimney is a kind of still-head, converging in an open top, and foot is often carried up thirty or forty feet, or more, to the top of these, and after this a black smoke is discharged out of the orifice, which disperses in the air, and finally seems to vanish.

From his accurate analysis of wood-foot, we may learn, says Boerhaave, that foot, which contains so many active principles, must be qualified for a powerful medicine. Pills of dry foot are found very beneficial in all cold distempers; the volatile salt of foot possesses the virtues of the volatile salts of animals. The salt which rises last is recommended greatly by Hartman for giving relief in cancers; and this is very probable, since sal ammoniac of the common kind, properly applied, is known to be of great use in cases of running cancers. Soots of different fuels are not all to be supposed to possess the same virtues; that of pit-coal is found to be a substance of a very different kind from that of wood; and that of the common turf or peat, and of the oak-wood, have also been found, on experiment, to be very different.

Boerhaave very justly observes, that the foot from kitchen-chimneys, where the smoke must have been impregnated with the effluvia of the victuals, must be very different from pure wood-foot. Boerhaave's Chemistry.

Wood-foot was formerly directed in hysterical cases, and in different nervous disorders, as an antispasmodic and corroborant. It was used chiefly in the form of a spirituous tincture,

in conjunction, commonly, with assa-fœtida, or other materials of similar intention: the officinal tincture was drawn from two ounces of foot, and one of assa-fœtida, with a quart of proof spirit.

The virtues of the foot are extracted almost equally by proof spirit, rectified spirit, and water, each of which, if the foot is of a good kind, dissolves about one-fourth of it.

The extracts, obtained by inspissating the filtered solutions, are very bitter, and the spirituous extract retains most perfectly the peculiar flavour of the foot. Lewis.

Dioscorides shews how to make a foot of butter, which was thought to have several uses in medicine. The foot found in furnaces of glass-houses is used by painters.

SOOTA, in *Geography*, a town of Japan, on the N. coast of the island of Sado.

SOOTEEAH, a town of Hindoostan, in Bahar; 15 miles N.N.E. of Chuprah.

SOOTEREE, a town of Bengal; 12 miles S.E. of Rangur.

SOOTICH, a town of Bengal; 15 miles N.N.E. of Kishenagur.

SOOTY, a town of Bengal; 30 miles N.E. of Calcutta. — Also, a town of Bengal; 27 miles N. of Moorshedabad. N. lat. 24° 25'. E. long. 88° 11'.

SOPE. See SOAP.

SOPEDIERO, in *Geography*, a town of Mexico, in New Biscay; 140 miles S.S.W. of Parral.

SOPETRAN, a town of Spain, in New Castile; 10 miles N. of Guadalaxara.

SOPHA, in *Ancient Geography*, a town of Palestine, in the tribe of Zebulon, according to Epiphanius.

SOPHANITÆ, a people of Arabia Felix, placed by Ptolemy in the southern part of that country.

SOPHAR, a town of Judea, in the tribe of Gad.

SOPHECLA, in *Geography*, a small island in the gulf of Engia; 5 miles N.W. of Engia.

SOPHENA, ZOPH, in *Ancient Geography*, a country of Asia, in the Greater Armenia, N. of Mesopotamia and Comagene, between the mountains Masius and Antitaurus, according to Strabo.

SOPHERA, in *Botany*. See CASSIA and SOPHORA.

SOPHI, or SORI, a title of quality, given to the emperor of Persia; importing as much as wise, sage, or philosopher.

The title is by some said to have taken its rise from a young shepherd thus named, who attained to the crown of Persia in 1370; others derive it from the *sophoi*, or *sages*, anciently called *magi*. Vossius gives a different account of the word: *sophi*, in Arabic, he observes, signifies wool; and he adds, that it was applied by the Turks out of derision to the kings of Persia, ever since Ismael's time; because, according to their scheme of religion, he is to wear no other covering on his head, but an ordinary, red, woolen stuff; whence the Persians are also called *hazalbaschs*, q. d. *red-heads*. But Bochart assures us, that *sophi*, in the original Persian language, signifies one that is pure in his religion, and who prefers the service of God in all things: and derives it from an order of religious called by the same name.

The *sophis* pride themselves, and with some reason, on their illustrious extraction; the race being second to none in the East. They are descended in a right line from Houssain, second son of Ali, Mahomet's cousin, and Fathima, Mahomet's daughter.

There is no prince in the world whose authority is more absolute than that of the *sophi* of Persia; his power is not even limited by any laws he himself can make; but he suspends, changes, and annuls them at pleasure. See SOHUS.

SOPHIA, or **SOFIA**, in *Geography*, a city of European Turkey, in Bulgaria, built by Justinian on the ruins of the ancient Sardica. This is the capital of Bulgaria, and a *sangiacat*; the see of a Greek archbishop, and of a Roman bishop. It is commercial, populous, and well-built, but without walls; and the streets are narrow, uneven, and dirty: 280 miles W.N.W. of Constantinople. N. lat. 42° 56'. E. long. 23° 14'.

SOPHIA Chirurgorum, in *Botany*, a name sometimes given to a species of water-crelles.

SOPHIAL, in *Geography*, a town of Russia, in the government of Petersburg; 16 miles S.S.E. of Peterburg. N. lat. 59° 40'. E. long. 13° 14'.

SOPHIANA, a town of Persia, in the government of Adirbeizan; or Azerbaijan; 24 miles N.W. of Tauris.

SOPHIENBERG, a town of Denmark, in the island of Zealand, near the coast of the Sound, with a royal palace; 13 miles N. of Copenhagen.

SOPHIENBURG, a town of Germany, in the principality of Culmbach; 5 miles S. of Bayreuth.

SOPHIENLUST, a town of Germany, in the county of Henneberg; 3 miles S. of Meinungen.

SOPHIS, or **SOFEEES**, denote a kind of order of religion among the Mahometans in Persia, answering to what are otherwise called *derwises*; and among the Arabs and Indians, *faqirs*.

Some will have them called *sophis*, from a kind of coarse camlet which they wear, called *souf*, from the city Souf, in Syria, where it is principally manufactured.

The more eminent of these *sophis* are complimented with the title *scheik*, that is, *reverend*; much as in Romish countries the religious are called *reverend fathers*.

Sheick Sophi, who laid the first foundation of the grandeur of the royal house of Persia, was the founder, or rather the restorer, of this order: *Ishmael*, who conquered Persia, was himself a *sophi*, and greatly valued himself on his being so. He chose all the guards of his person from among the religious of this order; and would have all the great lords of his court *sophis*.

The king of Persia is still guard-master of the order; and the lords continue to enter into it, though it be now fallen under some contempt.

The vulgar *sophis* are now chiefly employed as ushers and attendants of the court; and some even as executioners of justice; the emperor last reigning would not allow them, according to custom, to gird the sword on him.

This neglect into which the *sophis* are sunk, has occasioned the late emperor to disuse the title of *sophi*, or *sofi*: however, *M. de la Croix* is mistaken, when he says, that they never bore it.

SOPHIS, *Sofees*, or *Sufi's*, the denomination of a sect of modern philosophers among the Persians, whose name is derived either from the Greek word for a sage, or from the woollen mantle which they used to wear in some provinces of Persia. They seem, says sir William Jones (*Works*, vol. iii. p. 130. 8vo. ed.) to have adopted that metaphysical theology, which has been professed immemorially by a numerous sect of Persians and Hindoos, which was carried into Greece, and which prevails, even at this time, among the learned Mussulmans, who sometimes avow it without reserve. Their fundamental tenets are, that nothing exists absolutely but God: that the human soul is an emanation from his essence; and, though separated for a time from its heavenly source, will be finally reunited with it: that the highest possible happiness will arise from its reunion; and that the chief good of mankind, in this transitory world, consists in as perfect an union with the eternal Spirit, as the incumbrances

of a mortal frame will allow: that, for this purpose, they should break all connection with extrinsic objects, and pass through life without attachments, as a swimmer in the ocean strikes freely without the impediment of clothes: that they should be straight and free as the cypress, whose fruit is hardly perceptible; and not sink under a load, like fruit-trees attached to a trellis: that, if mere earthly charms have power to influence the soul, the idea of celestial beauty must overwhelm it in extatic delight: that, for want of apt words to express the divine perfections with the ardour of devotion, we must borrow such expressions as approach the nearest to our ideas, and speak of *beauty* and *love* in a transcendent and mystical sense: that, like a reed torn from its native bank, like *wax* separated from its delicious honey, the soul of man bewails its disunion with *melancholy music*, and sheds burning tears like the lighted taper, waiting passionately for the moment of its extinction, as a disengagement from earthly trammels, and the means of returning to its only Beloved.

Such, in part, is the wild and enthusiastic religion of the modern Persian poets, especially of the sweet *Hafiz*, and the great *Maulavi*. Such is the system of the *Vedanti* philosophers, and best lyric poets of India; and, as it was a system of the highest antiquity in both nations, it may be added to many other proofs of an immemorial affinity between them. The philosophy of the *Sofees* seems also, in early times, to have prevailed amongst the Jews, in Europe among the *Theosophists* (see that article), as well as among the disciples of the *Vedanti* school in India. Sir William Jones has expressed with great precision the tenets of the Indian school, nor do they differ from the doctrines maintained by the *Sofees* of the present day. The fundamental tenet of the *Vedanti* school, says sir W. Jones (*Works*, vol. iii. p. 239. 8vo. ed.) to which, in a more modern age, the incomparable *Sancara* was a firm and illustrious adherent, consisted not in denying the existence of matter; that is, of solidity, impenetrability, and extended figure; but in correcting the popular notion of it, and in contending that it has no essence independent of mental perception; that existence and perceptibility are convertible terms; that external appearances and sensations are illusory, and would vanish into nothing, if the divine energy, which alone sustains them, were suspended but for a moment, an opinion which *Epicharmus* and *Plato* seem to have adopted, and which has been maintained in the last century, and in our own country, with great elegance and acuteness by *Berkeley* and others. The *Sofees* consider themselves, as we have above stated, immersed in depravity by an union with matter, and in the figurative style of their poets, lament the separation from their beloved, and solicit, with impatient ardour, a release from a material and earthly bondage.

SOPHISM, Σοφισμα, in *Logic*, a captious and fallacious reasoning; or an argument, which, with some subtlety, carries much appearance of truth, but little solidity. See **FALLACY**.

A *sophism* is, properly, an argument false at bottom, and only invented to amuse and embarrass the person to whom it is used.

Logicians enumerate the following kinds of *sophism*, *viz.* *ignoratio elenchi*, or a mistake of the question, *i. e.* when something else is proved, which has neither any necessary connection nor inconsistency with the thing inquired, and consequently gives no determination to the inquiry, though at first sight it may seem to determine the question; *petitio principii*; a circle; *non causa pro causa*, or the assignation of a false cause; *fallacia accidentis*, which pronounces concerning the nature and essential properties of any subject, according

according to something which is merely accidental to it. *A dicto secundum quid ad dictum simpliciter*, arguing from that which is true in particular circumstances, to prove the same thing true absolutely, simply, and abstracted from all circumstances, and *vice versa*: the sophisms of composition and division, when we infer any thing concerning ideas in a compounded sense, which is only true in a divided sense, and *vice versa*: and the sophisms arising from an abuse of the ambiguity of words: to which may be added an imperfect enumeration, or false induction, when from a few experiments and observations, men infer general theorems and universal propositions. Watts's Logic, p. iii. c. 3. sect. 1.

These sophistical modes of reasoning, or logical quibbles, called by Aristotle Eristic syllogisms, were introduced into the Megaric school, founded by Euclid of Megara, (see his article,) by Eubulides of Miletus, who in that school succeeded Euclid; but as they furnished merely examples of egregious trifling, they deserve no farther notice. The Stoics also amused themselves with quibbles and fallacies of the same kind with those of the Megaric school, of which the following example will be sufficient. Protagoras the sophist (see PROTAGORAS) agreed to instruct a young man in eloquence for a large sum, one half of which was to be paid in hand, the other half upon his first successful pleading in the courts. Neglecting to plead for a long time after Protagoras had completely instructed him in the art of rhetoric, the sophist sued him for the remaining moiety of his stipend. Each pleaded his own cause. Protagoras urged, that which way soever the cause was determined, the young man must complete the payment: for if the cause was determined *against* the defendant, the payment would be granted him by judgment; if *for* him, the payment would be due according to agreement. The young man, on the contrary, pleaded, that if the cause was determined *in his favour*, he should be excused from the payment by the decision of the court; if *against* him, Protagoras, by his own agreement, could have no demand upon him. The subtlety of these pleas perplexed the judges; and, without coming to any determination, they dismissed the court.

SOPHISMS, or *Sophistical Arguments*, among *Logicians*, are more particularly such as are not in form, or are founded on equivocal.

As, *You have every thing you have not lost; but you have not lost horns, therefore you have horns.*

SOPHIST, Σοφιστής, formed from σοφός, *wise*, or rather from σοφιστής, *impollor, deceiver*, a person who frames sophisms; that is, uses subtle arguments, with design to deceive those whom he would persuade or convince.

The term *sophist*, which is now reproachful, was anciently honourable, and carried a very innocent idea. St. Augustine observes, it signifies a rhetor, or professor of eloquence: such as were Lucian, Athenæus, Libanius, &c. Suidas, and after him Olar. Celsius, in an express dissertation on the Greek sophists, tells us, that the appellation was applied indifferently to all who excelled in any art or science; whether divines, lawyers, physicians, poets, orators, or musicians.

However, as rhetoricians often employed their art rather to vindicate what was false and unjust, than to support truth and virtue, their conduct brought a discredit both upon themselves and their profession; and, therefore, the name *sophist*, sometimes confounded with that of *sophistler*, has been used in an ill sense, to signify a specious but false reasoner, one skilled rather in the arts of cavilling than qualified to speak well and accurately upon any subject.

Solon is the first who appears to have ever borne the ap-

pellation of *sophist*, which is given him by Isocrates; afterwards, it was scarcely ever given, except to philosophers and declaimers.

In the time of Socrates, there was in Athens a large body of professional preceptors of eloquence, distinguished by the appellation of *sophists*. By the mere pomp of words, these men made a magnificent display of wisdom, upon a slight foundation of real knowledge; and they taught an artificial structure of language, and a false method of reasoning; by means of which they were able, in argument, to make the worse appear the better cause. Whilst they arrogated to themselves the merit of every kind of learning, they publicly practised the art of disputing with plausibility on either side of any question, and professed to teach this art to the Athenian youth. By these imposing pretensions, they collected, in their schools, a numerous train of young men, who followed them in hope of acquiring those talents, which would give them influence and authority in popular assemblies. In such high repute were these *sophists*, that they were literally supported, not only by contributions from their pupils, but by a regular salary from the state; and were in many instances distinguished by public honours, and employed in offices of magistracy. Of their enmity to Socrates, we have given an account under his biographical article.

The title *sophista* was in great credit among the Latins in the twelfth century, and in the time of St. Bernard; but it began to lose ground in Greece as early as Plato's time; on account of Protagoras and Gorgias, who made a fordid traffic of it, by selling eloquence for money. Hence Seneca calls the *sophists* quacks, or empirics.

Cicero says, that the title *sophisti* was in his time given to such as professed philosophy with too much ostentation, in order to make a trade of it, by running from town to town, to retail their deceitful science. A *sophist*, therefore, was then, as now, a rhetor, or logician, who makes it his business to ensnare and perplex people, by frivolous distinctions, vain reasonings, and captious discourses.

Nothing has conduced more to the increasing of the number of *sophists* than the contentious school-philosophy: people are there taught to puzzle and obscure the truth, by barbarous unintelligible terms; as, antipredicaments, great and little logicals, quiddities, &c.

The title *sophist* was given to Rabanus Maurus, by way of eminence. John Hinton, a modern English scholastic writer, endeavoured also to procure the splendid title of *sophist*.

SOPHISTICATIO, in *Chemistry, Alchemy*, &c. a term particularly applied to the counterfeit works of fraudulent alchemists, who use indirect means of whitening copper, gilding silver, and giving other superficial tinctures to metals; as also of making augmentations, by divers mixtures, and other illegal operations, to delude those at whose expence they are employed.

Hence the term is also applied to merchandizes, and other goods adulterated, mixed, or altered, by the deceit of the seller.

SOPHOCLES, in *Biography*, a celebrated tragic poet, was born at Athens about the year 497 B.C. He received an education in every way suitable to his rank in life; and it appears that he was but a youth, when the monuments of the victory over Xerxes were fixed up at Salamis, and then he went at the head of a chorus of noble birth, whose song of triumph he led by the strains of his lyre. He first applied himself to lyric poetry; but the fame acquired by Æschylus, the author, or at least the great reformer, of Grecian tragedy, induced him to try his powers in that

species of composition; and in his 28th year he ventured to contend with that veteran for the theatrical prize. He obtained the victory, which was followed by the retreat of his rival, who left him the undisputed master of the tragic stage. The improvements introduced by Sophocles were so great, that he has generally and justly been regarded as the father of the regular tragedy. "He brought," says the critic, "a third interlocutor to the two who before alone appeared on the scene at once; he interested the chorus in the subject of the piece; he reduced the turgid and unnatural diction of Æschylus to the proper standard of heroic dignity; and invented that artful construction of fable and development of incidents, which contribute so much to the interest of a dramatic performance." In these points he was superior to his younger competitor Euripides; and upon the whole, he appears to have stood at the head of his class, in the judgment both of Greek and Roman critics. Cicero terms him a *divine poet*; and he is highly commended by Dionysius of Halicarnassus, for preserving the dignity of his characters, and dwelling rather on the more noble and generous affections, than on the mean and debasing passions. These praises shew that his works were regarded as the most perfect example of tragedy, in the highest sense of the word. Sophocles was a statesman, as well as a tragedian, and entrusted with very important civil and military employments. He retained his faculties to the last, and continued to write tragedies to an advanced age; and when his unnatural sons, on account of some neglect in his domestic affairs, applied to the magistrates to put him under their guardianship, as having outlived his understanding, he appeared in court, an advocate in his own cause, and reciting his *Œdipus at Colonus*, which he had just finished, appealed to the judges and auditors, if that were the work of the dotard described by his own children. The sentence was pronounced unanimously in his favour, and he was carried home with every mark of triumph. The benignity of his character acquired him a number of friends, his attachment to whom, and his moderate wishes, caused him to decline the invitations of the kings who were desirous of drawing him to their courts. He paid every token of respect to the memory of his rival Euripides, thus demonstrating that he was incapable of the meanness of jealousy. He lived to the great age of 90, and is said even at that age to have died with joy, on obtaining the prize for his last tragedy. Above a hundred pieces have been attributed to him by some ancient writers, of which, however, only seven have reached our times. Of these, both separately and collectively, many editions have been made. Among the most esteemed are Johnson's, 3 vols. 8vo. Oxon. et Lond.; Capperonier's, Par. 4to.; Brunck's, 2 vols. royal 8vo. 1786; and Mulgrave's, Oxon. 2 vols. 8vo.

SOPHONE, in *Ancient Geography*, a country of Asia, situated in the place where the Tigris re-appears, after having been under ground for the space of 25 miles, according to Justin.

SOPHORA, in *Botany*, a name of most whimsical origin. *Sophera* is, according to Prosper Alpinus, the Egyptian denomination of a species of *Cassia*, the Linnæan *C. Sophera*, nearly related to the genus before us. Linnæus, in his *Hortus Cliffortianus*, 156, spelling it *Sophora*, calls it a *genus Sopherum*, or of wise men; as teaching that separate stamens, in the papilionaceous family, if ever the limits of that family can be determined, afford so decisive a mark of discrimination, as almost to exclude the plants furnished with such, from the same natural class, or order, with those whose filaments are combined. The soundness of the doctrine may make us tolerate the conceit.—Linn. Gen.

204. Schreb. 275. Willd. Sp. Pl. v. 2. 499. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 3. 2. Juss. 351. Lamarck Illustr. t. 325. Gært. t. 149, tomentosa. (Edwardia; Salis. in Tr. of Linn. Soc. v. 9. 298. Ait. Hort. Kew. v. 3. 1.)—Class and order, *Decandria Monogynia*. Nat. Ord. *Papilionaceæ*, Linn. *Leguminosæ*, Juss.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, short, oblique; gibbous on the upper side; its tube turbinate, angular; limb bell-shaped, abrupt, with five teeth. *Cor.* papilionaceous, of five petals. Standard oblong, straight, dilated upwards, flexed at the sides, various in length. Wings two, as long as the standard, or longer, with a lobe at the base. Keel of two petals, similar to the wings and about the same length, their lower edges close together, boat-like. *Stam.* Filaments ten, inserted into the tube of the calyx, distinct, parallel, rigid, awl-shaped, about the length of the corolla, and lodged in its keel, deciduous; anthers small, oval, incumbent. *Pist.* Germen superior, oblong, slender, nearly cylindrical; style the size and shape of the stamens; stigma simple, obtuse. *Peric.* Legume very long and slender, of one cell, and two imperfect valves, swelling at each seed, so as to become beaded; often angular or winged. *Seeds* numerous, roundish, large, polished.

Ess. Ch. Calyx bell-shaped, oblique, five-toothed; turbinate at the base. Corolla papilionaceous. Legume beaded, scarcely bursting, with many seeds.

We have under EDWARDSIA (see that article) expressed an opinion unfavourable to the permanency of that genus of Mr. Salisbury's, though we have many reasons for wishing we could admit it; nor does our decision at all interfere with the propriety of the name. Our reasons will appear presently. The genus of *Sophora* is, nevertheless, commodiously divisible into two sections, by the situation of the inflorescence, but this can make no generic distinction, unless it were supported by some character in the fructification, such as the learned editors of the *Hortus Kewensis* thought they had found in the legume; but it is overset by a new species before us; see n. 5.

SECTION I. *Clusters terminal, elongated.*

1. *S. tomentosa*. Downy Sophora. Linn. Sp. Pl. 533. Willd. n. 5. Ait. n. 1. (*S. occidentalis*; Linn. Sp. Pl. 533. Willd. n. 6. *S. arborescens*, &c.; Trew's Ehret. 27. t. 59. *Colutea zeylanica argentea tota*; Herm. Lugd.-Bat. 169. t. 171. Galea? n. 1; Browne Jam. 289. t. 31. f. 1.)—Stem arboreous. Leaflets numerous, roundish-elliptical, very obtuse, downy as well as the calyx.—Native of the East and West Indies. Long cultivated in our stoves, but it has seldom flowered. The *branches, stalks, foliage*, and *inflorescence*, are more or less clothed with short, dense, hoary pubescence. *Leaves* a span long, of six or seven pair, with an odd one, of stalked, elliptical, coriaceous leaflets, all nearly equal and uniform, above an inch long; sometimes their upper surface is smooth, and the whole of the plant much less downy than usual. *Stipulas* none. *Clusters* terminal, solitary, stalked, simple, generally a foot long, composed of very numerous, large, elegant, pale-yellow flowers. *Legume* three or four inches in length, beaded, two-edged, slightly downy, often interrupted here and there by a failure in the impregnation of some of the seeds, which, when perfect, are the size of a large pea, globular, brown, discharged finally by the decay, and partial splitting of the valves.

2. *S. heptaphylla*. Seven-leaved Sophora. Linn. Sp. Pl. 533. Willd. n. 8. (*Anticholericæ*; Rumph. Amboin. v. 4. 60. t. 22.)—Stem shrubby. Leaflets about seven, elliptical, acute; downy beneath.—Native of the East

SOPHORA.

Indies, on sandy or rocky sea-coasts. Rumphius describes it as about the size of a Privet-bush, but with a thicker trunk. He says there are seven, eight, or nine pair of *leaflets*, besides an odd one; dark green above; downy and grey beneath; hardly two inches long, about one broad. Linnæus describes seven smooth *leaflets* in all. The *flowers* are yellowish. *Legumes* beaded. Having seen no specimen, we forbear all further description; only excluding, without hesitation, the *Fruticulus sinensis, senæ sylvestris folio*, &c. Pluk. Amalth. append. t. 451. f. 10. (See the next species.) The *root* and *seeds* of the plant of Rumphius are celebrated by him as inestimable remedies for dangerous bilious colics.

3. *S. japonica*. Japanese Sophora. Linn. Mant. 68. Willd. n. 7. Ait. n. 2. Thunb. Jap. 178. Andr. Repof. t. 585. Jacq. Hort. Schoenbr. v. 3. 55. t. 353.—Stem arborescent. *Leaflets* ovato-lanceolate, acute, smooth. *Clusters* compound, panicled.—Native of Japan and China. Introduced by the celebrated cultivator Mr. James Gordon, in 1753. It has been nearly as long cultivated about Paris, where it was called *l'arbre inconnu des Chinois*. This is a tall and handsome hardy deciduous tree, with elegant, smooth, pinnate *leaves*, whose *leaflets* are about an inch and a half long, and half an inch broad, acutely pointed. *Flowers* smaller than those of Laburnum, of a pale greenish-yellow, almost white, composing numerous, branched, spreading *clusters*, collected into large, terminal, upright *panicles*. *Legumes* pendulous, two or three inches long, turgid, smooth. By Jacquin's figure the withered *stamens* seem permanent. Perhaps Plukenet's Amalth. t. 451. f. 10, cited with doubt by Linnæus for *S. heptaphylla*, may belong to this.

4. *S. alopecuroides*. Fox-tail Sophora. Linn. Sp. Pl. 533. Willd. n. 4. Ait. n. 3. (Glycirrhiza filiquis nodosis, quasi articulatis; Buxb. Cent. 3. 25. t. 46. Ervum orientale alopecuroides perenne, fructu longissimo; Dill. Elth. 136. t. 112. f. 136.)—Stem herbaceous. *Leaflets* elliptic-oblong, obtuse; somewhat silky beneath, when full grown.—Native of the Levant, hardy in our gardens, where it was cultivated in the days of Miller and Sherard, flowering in July and August. The *root* is perennial, creeping extensively. *Stems* annual, herbaceous, simple, leafy, about two feet high. *Leaflets* numerous, about an inch long, green, sparingly pubescent. *Clusters* simple, solitary at the top of each stem, without much of an elongated stalk, composed of numerous, pale, greenish-white, sweet-scented *flowers*, larger than those of the common *Galega officinalis*. *Calyx* nearly smooth. *Legume* slender, somewhat silky. Dillenius noticed the ten distinct *stamens*; and he asserts that to make the plant flower freely, the roots must be confined in a pot.

5. *S. flavescens*. Siberian Sophora. Ait. ed. 1. v. 2. 43. ed. 2. n. 4. Willd. n. 3.—“Stem herbaceous. *Leaflets* ovate-oblong, nearly smooth.”—Native of Siberia; introduced here in 1785, by Mr. John Bell. A hardy perennial, flowering from May to July. We have seen no specimen. Willdenow says it is like the preceding, but entirely smooth. *Leaflets* six pair, with an odd one, ovato-lanceolate, bluntish. *Calyx* obscurely toothed. Mr. Salisbury recommends the separation of these two last from *Sophora*, on account of their permanent *stamens*; but it seems to us that *S. japonica* connects them with the original species, both by that character, and somewhat of habit, or aspect.

Section 2. *Clusters lateral, shorter than the leaves.*

6. *S. macrocarpa*. Great-seeded Sophora.—*Leaflets* elliptic-oblong, nearly smooth. *Clusters* axillary, very

short. *Legume* silky, two-edged, tumid, without wings.—Native of Chili, where it is commonly known by the name of *Mayo*. We received fine specimens from the late abbé Cavanilles, in 1804. The *stem* is arborescent. *Branches* roundish, knotty; silky when young. *Leaves* deciduous, about a finger's length, composed of from six to nine pair of, not exactly opposite, obtuse, rigid *leaflets*, three quarters of an inch long, besides an odd one, all green; shining, and sparingly downy, above; paler, and rather silky, beneath. *Clusters* towards the ends of the branches, axillary, simple, composed of four or five large yellow *flowers*, whose partial stalks are about the length of the common one, all silky, as well as the *calyx*. *Stamens* occasionally permanent. *Legume* from three to five inches long; when young compressed, two-edged, and finely silky; where the *seeds* ripen, they form large oval swellings, almost as big as a bullace plum, partly deprived of their downiness, and marked with a slight ridge along each side, as in *S. tomentosa*, but quite destitute of angles, wings, or other inequalities. In inflorescence, habit, and aspect of the *flowers*, this species accords exactly with all the following ones, while its *legume* is that of the original *Sophora*. We conceive, therefore, that it oversets the genus *Edwardia*, to which, if that genus exists at all, the present plant should belong, and yet its *legume* is neither quadrangular nor winged, nor is there any character in the fructification at all different from *Sophora*.

7. *S. nitida*. Silky-leaved Sophora.—*Leaflets* elliptic-oblong, silky on both sides. *Clusters* axillary, very short. *Legume* hairy, with four prominent angles.—Gathered by Commerson, in the isle de Bourbon. An elegant silky *shrub* or *tree*. *Leaves* two or three inches long, composed of from eight to twelve pair of *leaflets*, half the size of the last, beautifully silky, as well as their stalks; brighter beneath. The *flowers* are past in our specimen; their *stalks* are much like the last, but more hairy, with larger, more permanent, opposite *bractæas*. Half-ripe *legumes* about four inches long, rather slender, beaded, their four thick prominent angles much more hairy than the interstices, which should seem to become quite smooth as the oval parts, enclosing the *seeds*, are more enlarged.

8. *S. tetraptera*. Four-winged Sophora. Ait. ed. 1. v. 2. 43. Willd. n. 1. J. Mill. Ic. t. 1. Curt. Mag. t. 167. Lamarek f. 3. Roem. and Uft. Mag. fasc. 12. t. 1. (*Edwardia grandiflora*; Salis. Tr. of Linn. Soc. v. 9. 299. Ait. Hort. Kew. v. 3. 1.)—*Leaflets* elliptic-oblong, silky on both sides. *Clusters* lateral. *Legume* slightly hairy, with four membranous crenate wings.—Discovered in New Zealand, by sir Joseph Banks, and brought in 1772 to this country, where it thrives well against a fourth or west wall, in the open air, with only the protection of a mat in winter, flowering about May or June. Few shrubs are more ornamental. The silky *leaves* are much like the last, but rather larger. *Flowers* about six together, in silky-stalked, drooping clusters; each *flower* near two inches long. The brown *stalks* and *calyx* are strikingly contrasted with the golden *petals*, whose standard is shorter, and of a fuller yellow, than the rest. *Legume* three or four inches long, each tumid part, where a seed is lodged, bordered, at each side of the suture, with two parallel wings, the whole *legume* being somewhat compressed, and not uniformly winged in four directions, like that of *Lotus tetragonolobus*. The base or tube of the *calyx* is, in this species, broader, or more dilated, than in most of the rest, besides having ten ribs. But we find it precisely analogous to the same part in *S. tomentosa*, and others, where it always has a different colour, texture, or appearance, from the limb.

9. *S. chrysophylla*. Golden-leaved Sophora. (Edwardia chrysophylla; Salis. Tr. of Linn. Soc. v. 9. 299. t. 26. f. 1.)—Leaflets obovate, emarginate, silky. Clusters lateral. Legume—Gathered in the Sandwich islands, by Mr. Menzies. The leaflets are thrice as broad as in the foregoing; flowers yellow, about half the size of that species. Nothing is known respecting the legume.

10. *S. microphylla*. Small-leaved Sophora. Ait. ed. 1. v. 3. 43. Willd. n. 2. Lamarck f. 1. Jacq. Hort. Schoenbr. v. 3. 10. t. 269. (*S. tetraptera*; Forst. Prodr. 32. Linn. Suppl. 230.)—Leaflets numerous, roundish-obovate, somewhat silky. Clusters lateral. Legume with four membranous crevate wings.—Discovered by Banks, Forster, and others, in New Zealand. Introduced in 1772 to the notice of British cultivators. It is usually treated here as a greenhouse shrub, though marked as hardy by Mr. Aiton, flowering in May and June. The younger Linnæus, like Forster, confounded this with *S. tetraptera*, n. 8, though our native specimen, from the latter, is marked *microphylla*. It differs essentially from *tetraptera*, though their legumes are similar, in having flowers not above half so large, and especially in the rounded figure, and small size, of its numerous leaflets, whose silky pubescence, most conspicuous on their under side, is silvery, not of a tawny or golden hue, even after long keeping.

For other species, formerly referred to this genus, see ORMOSIA and PODALYRIA.

SOPHORA, in Gardening, contains plants of the herbaceous, flowery, perennial, and shrubby exotic kinds, of which the species (as some have reckoned them) cultivated are, the wing-podded sophora (*S. tetraptera*); the small-leaved shrubby sophora (*S. microphylla*); the fox-tail sophora (*S. alopecuroides*); the blue sophora (*S. australis*); the dyer's sophora (*S. tinctoria*); the white sophora (*S. alba*); the downy sophora (*S. tomentosa*); the occidental sophora (*S. occidentalis*); the thining-leaved sophora (*S. japonica*); the vetch-leaved sophora (*S. capensis*); the golden-flowered sophora (*S. aurea*); and the round-leaved sophora (*S. myrtillifolia*).

Method of Culture.—The first five sorts are hardy, and may be increased by seeds, or parting the roots. The seeds should be sown in the spring, in pots of fine mould; and when the plants are come up, they should be removed into separate pots, till they have obtained sufficient strength, when they may be planted out where they are to grow. The roots may likewise, in many of the sorts, be parted at the same season, and planted in pots, or where they are to remain. The first and second sorts may also be raised from cuttings and layers, planted or laid down at the same season. These, when planted against a wall, so as to be protected from the frost in winter, succeed very well.

But all the other sorts are tender, and require the protection of the hot-house or stove. They are increased by sowing the seed in the early spring, in pots filled with fine mellow light mould, and plunging them in the hot-bed under glasses, or in the bark-bed. When the plants have advanced a little in growth, they should be removed into separate pots, filled with soft loamy mould, being well watered, and replunged in the bark-bed till fresh rooted; being afterwards managed as other exotic stove plants, with but little water. They likewise sometimes succeed by layers and cuttings, treated in the same manner.

It may be noticed, that the first sorts afford variety in the borders, and among potted plants; and the latter in stove collections, where heat is required. Many of the tender sorts are very elegant plants, proper for affording ornament and curiosity in such situations.

SOPHRONISTÆ, σωφρονισται, among the Athenians,

were ten officers, appointed to take care that the young men behaved themselves with sobriety and moderation.

SOPHRONISTERIUM, σωφρονιστηριον, among the Athenians, a house of correction, like our Bridewell.

SOPIANÆ, in *Ancient Geography*, a town of the Lower Pannonia, upon the route from Sirmium to Carnuntum, between Antiana and Mansuetianus, according to the Itinerary of Antonine.

SOPIO, a name used by some of the old writers for opium, from its soporific virtue.

SOLOPO, in *Geography*, a town of Turkish Albania; 32 miles S.S.E. of Valona.

SOPORARIÆ ARTERIÆ, a name given by some authors to the carotid arteries.

SOPORIFIC, or SOPORIFEROUS, a medicine that has the faculty of procuring sleep. Such are opium, laudanum, &c.

The word is formed from the Latin *sopor*, sleep. The Greeks, in lieu of it, use the word *hypnotic*.

SOPOROUS, SLEEPY, or *Drowsy diseases*, a term by which medical writers express the lethargy and coma, and some others even the carus and apoplexy.

SOPPAU, in *Geography*, a town of Silesia, in the principality of Jagerndorf; 5 miles N. of Jagerndorf.

SOPPY, a town on the N.W. coast of the island of Mörty. N. lat. 2° 40'. E. long. 128° 15'.

SOPRA, Ital. above, upper: as *nelle parte di sopra*, in the upper parts; *di sopra*, above; *contrapunto sopra il soggetto*, counterpoint above the subject. See SOGGETTO.

SOPRANO, in *Italian Music*, means supreme, or the highest vocal part. Its clef is that of the tenor or C clef on the first line. Music for a soprano or treble voice in Italy, is always written in the C clef on the first line, thence called the soprano clef. The treble or G clef, in which we write vocal treble parts, is called by the Italians, *chiave di violino*, the violin clef, and only used for the highest parts of instrumental music.

SOPRON, in *Geography*. See EDENBURG.

SOQUA, a town of the duchy of Warfaw; 60 miles N. of Warfaw.

SOR, a river of France, which runs into the Agout, six miles below Castres.

SOR. See TSOR.

SORA, in *Botany*, the name given by the people of Guinea to a kind of shrub which they use in medicine, boiling it in water, and giving the decoction in cases of pain of any kind.

The leaves of this shrub are of the size and shape of those of fenna; they stand upon short footstalks, and are woolly underneath. *Philos. Trans.* No. 231.

SORA, in *Ancient Geography*, a town of Arabia Deserta, on the confines of Mesopotamia. Ptolemy.—Also, a town of India, on this side of the Ganges, according to Ptolemy, who gives it the title of "Arcati Regia."—Also, the name of a town of Phœnicia. *Steph. Byz.*—Also, a town of Italy, in Latium, towards the N.E., upon the Lixis. According to Livy, it belonged to the Samnites.

SORA, in *Geography*, a town of Naples, in Lavora, the see of a bishop, immediately under the pope; 31 miles N.N.W. of Sezza. N. lat. 41° 47'. E. long. 13° 36'.

SORACTES, in *Ancient Geography*, mountains of Italy, in Etruria, on the confines of the country of the Falisci, and in the vicinity of the Tiber.

SORÆ, a people of India, who dwelt in the vicinity of Carmania and Gedrosia, near the river Caberon, according to Pliny.—Also, a people of India, on this side of the Ganges, counted

counted among the Nomades by Ptolemy, who places them between the mountains Bitigus and Difathrus.

SORÆI, a people of Africa, in Mauritania Cæfariensis. Ptolemy.

SORAGNA, in *Geography*, a town of the duchy of Parma; 13 miles N.N.W. of Parma.

SORAMIA, in *Botany*, Aubl. Guian. t. 219. Juss. 433. See MAPPIA.

SORANUS, in *Medical History*, one of the most able of the physicians of the *methodic* sect, according to the opinion of Cælius Aurelianus, and the one who put the finishing hand to that system, was a native of Ephesus. His father's name was Menander, and that of his mother Phæbe. He studied medicine, and afterwards practised it at Alexandria, but at length he settled at Rome, and was in considerable repute in that metropolis in the reigns of Trajan and Adrian. His character, indeed, seems to have been highly estimated; for he was in favour with all parties. Even Galen, who was violent in his opposition to the *Methodists*, and abused Thesalus with some acrimony, speaks favourably of the knowledge of Soranus, and bears his testimony, from experience, to the efficacy of some of his remedies. Soranus composed several works, none of which have come down to us in their proper form; but as Cælius Aurelianus, in his treatise "De Morbis Acutis et Chronicis," every where acknowledges himself to be a translator from the Greek of Soranus, that work may be considered as in substance the production of the latter.

Some confusion prevails among medical writers, who mistake Soranus the Methodist for two other physicians of the same name. The first of these was also a native of Ephesus, but posterior to the Methodist. He was the author of a good treatise on the diseases and organs of generation of women, which was printed at Paris in 1556, under the title of "De Utero et Muliebri pudendo libellus," together with some pieces of Rufus, the Ephesian. This fragment is so accurate in point of anatomical description, as to leave a regret that the other writings of this physician are lost. The third of these physicians of the name of Soranus, was surnamed *Melotas*, from the town in Cilicia, where he was born. There is, however, no very authentic record of him extant; and the only work ascribed to him, which is entitled "Isagoge saluberrima in Artem medendi," and was printed at Basle, 1528, and Venice, 1547, is maintained by Vossius to be the work of a posterior Latin writer, and not of any of the three persons named Soranus. See Le Clerc, Hist. de la Med. Eloy Dict. Hist.

SORARUM, in *Geography*, a town of Hindooistan, in the circuit of Cicacole; 10 miles W. of Cossimcotta.

SORAS, a town and jurisdiction of Peru; 60 miles S. of Guamanga.—Also, a town of Italy, in the Feltrin; 8 miles W.S.W. of Feltri.

SORAU, or ZYORY, a town of Silesia, in the principality of Ratibor; 18 miles E. of Ratibor. N. lat. 50° 1'. E. long. 18° 40'.

SORAW, or ZAROW, a town of Lusatia, and one of the most ancient towns in the country, surrounded with walls in the year 1207. It has manufactures of cloth, and a considerable trade in linen and yarn; 25 miles S.S.E. of Guben. N. lat. 51° 37'. E. long. 15° 10'.

SORBA, a town of France, in the department of Jemappe, and chief place of a canton, in the district of Corté. The canton contains 2000 inhabitants.

SORBAIT, PAUL DE, in *Biography*, a physician of eminence, was a native of Hainault, in the Low Countries. Having finished his courses of classical and philosophical studies, he commenced that of medicine, which he appears

to have concluded by taking the degree of doctor in that faculty at Vienna, where he ultimately settled. He obtained a high reputation for medical skill and erudition; and, in 1655, was appointed to the principal professorship of medicine in the university of that metropolis, the duties of which he executed with considerable celebrity, until the year 1679. While he was engaged in his course of this year, he was honoured with the appointment of physician to the dowager empress Eleanor, and at the conclusion of it, relinquished altogether his academical avocations. His merits were still farther rewarded by the office of counsellor and superintendent of the public health, and by his elevation to the dignity of a knight of the kingdom of Hungary. He died in April 1691, at an advanced age. He left several works, namely, a body of medical practice, first published at Nuremberg, in 1672, folio, with the title of "Univerſa Medicina, tam Theorica quam Practica, nempe Isagoge Institutionum Medicarum et Anatomicarum, &c." This work was republished at Vienna in 1680, and again after his death, in 1701, with the new title of "Praxeos Medicæ auctæ, et a plurimis typi mendis ab ipſo Auſtore calligatæ, Tractatus VII. &c." "Nova et aucta Institutionum Medicarum Isagoge," 1678, 4to. "Commentaria et Controversiæ in omnes Libros Aphorismorum Hippocratis," 1680. In the preceding year he published an account of the plague, which had committed dreadful ravages in Vienna, having destroyed, he affirms, not less than 76,921 persons. Its title was "Consilium Medicum, sive Dialogus Loimicus de Peste Viennensi," 1697; and he published the same work, in German, in 1680. He was author also of "A Treatise on Midwifery," in the German language. Eloy Dict. Hist. de la Med.

SORBECKE, in *Geography*, a river which rises in Westphalia, and runs into the Rhur, about two miles S. of Neheim.

SORBELLONI, in *Biography*, a second rate Italian opera singer in *soprano*, who arrived here in 1761; and who, from the mere sweetness of his voice, free from vulgarity, was always much applauded. He was here at the same time as Paganini, and performed the part of serious man in the burlettas of the time.

SORBIERE, SAMUEL, was born in 1615, at St. Ambroix, in the diocese of Uzez. He was educated by his maternal uncle, an eminent Calvinist minister at Nismes. He came to Paris in 1639, and being disgusted, for some reasons not now known, with the study of theology, he took up that of medicine. In 1642 he went to Holland, where, besides pursuing his medical studies, he materially assisted in the translation of Camden's Britannia, and also More's Utopia. He married, in Holland, the daughter of one of his townsmen, and went to Leyden, with the intention of settling in his profession. In 1648 he published, under his own name, a French version of a treatise of Gallendi, entitling it "Discours sceptique sur le Passage du Chyle, et le Mouvement du Cœur." Returning to France in 1650, he was made principal of the college of Orange, and there printed a Discours on the true cause of the troubles of England, and a letter on the designs of Cromwell. He conformed to the Catholic religion in 1653, after which his life was chiefly spent as an author, with a view, it is said, of attempting to obtain pensions, in which he was very successful, having laid under contribution cardinal Mazarin, Lewis XIV., and the popes Alexander VII. and Clement IX. He visited England in 1664, and on his return he published an account of what he had observed, which was so free in its strictures, that he was for a time exiled by a *lettre de cachet*. Sorbier was likewise author of a work entitled "Lettres et Discours sur divers Matières curieuses,"

curieuses," which contributed to his temporary reputation. He died in 1670, and a *Sorberiana* was published after his death, containing sentiments supposed to have dropt from him in conversation. His writings exhibit a caustic and satirical spirit, and the learning which they display is neither original nor solid. He was intimately connected with Hobbes and Gaffendi, on whom he imposed himself as a profound thinker.

SORBIODUNUM, in *Ancient Geography*. See **SORVIDUNUM**.

SORBOE, in *Geography*, a small island in the North sea, near the coast of Norway. N. lat. 59° 5'.

SORBOLE, a town of Sweden, in West Bothnia; 10 miles S.W. of Umea.

SORBONNE, **ROBERT DE**, in *Biography*, founder of the famous theological college which bears his name, was born in 1201, of an obscure family at Sorbon, in the diocese of Rheims. Being educated at Paris, and having taken his degree of doctor, he devoted himself to preaching, in which he became so celebrated, that the king made him his chaplain and confessor. Having become a canon of Cambrai in 1251, the recollection of the difficulties which he had experienced in the course of his own studies, suggested to him a plan for facilitating to poor scholars the means of proceeding to graduation. This was to form a society of secular ecclesiastics, who, living in common, and provided with a regular maintenance, should read lectures gratuitously. With the assistance of his friends, he founded the college called the Sorbonne, which was particularly consecrated to the study of theology, and its constitution has served as a model for that of all colleges since erected in that country. Sorbonne afterwards added to this foundation a college for the languages and philosophy, under the name of the College of Calvi, or the Little Sorbonne. He was made canon of Paris in 1258, and rose to such a height of reputation, that princes looked to him on many important occasions as the arbitrator in their disputes. He died in 1274, at the age of 73, and left considerable property to his college. He was author of several works on theological subjects, which are preserved in MS. in the library of the great college of which he was the liberal founder.

SORBONNE, or **SORBON**, the house or college of the faculty of theology, established in the university of Paris.

It was founded in 1256, by St. Louis, or rather by Robert de Sorbonne, his confessor and almoner; first canon of Cambrai, and afterwards of the church of Paris; who gave his own name to it, which he himself took from the village of Sorbon, or Serbon, in the department of the Ardennes, near Sens, six miles N. of Rethel, where he was born.

The foundation was laid in 1250, afterwards the king gave him all the houses he had in the same place, in exchange for some others in another.

The college has been since magnificently rebuilt by the cardinal de Richelieu. The design of its institution was for the use of poor students in divinity.

There were lodgings in it for thirty-six doctors and bachelors of the house; who were said to be of the *society of the Sorbonne*. Those admitted into it without being doctors were said to be of the *hospitality of the Sorbonne*. Six regent doctors held lectures every day, for an hour and half each: three in the morning, and three in the afternoon.

SORBONNE has been also used in the general for the whole faculty of theology at Paris, because the assemblies of the whole body were held in the house of the Sorbonne: and because the bachelors of the other houses of the faculty, as the house of Navarre, &c. came thither to hold their *sorbonnique*, or act, for being admitted doctors of divinity.

SORBUS, in *Botany*, a word usually derived by critics from *forbeo*, to fuck in; because its fruit *Sorbum*, the Sorb-apple, or Service, see **SERVICE-TREE**, is not eatable till the pulp becomes quite soft, so as to be fucked rather than bitten. De Theis, however, goes to the recondite sources of Celtic learning for its origin; *Sornel*, the name of the fruit in that language, being, as he says, formed of *for*, harsh or rude, and *mel*, an apple.—Linn. Gen. 250. Schreb. 338. Willd. Sp. Pl. v. 2. 1008. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 3. 204. Juss. 335. Lamarck Illustr. t. 434.—Class and order, *Icosandria Trigynia*, Linn. Nat. Ord. *Pomacea*, Linn. *Rosacea*, Juss.

This genus, consisting, in most authors, of three species, *S. aucuparia*, *hybrida*, and *domestica*, we refer, without scruple, as in the *Flora Britannica*, to **PYRUS**; see that article, n. 24, 25, 26. See also **MESPILUS**.

SORBUS, in *Gardening*, contains plants of the ornamental tree kind, among which the species cultivated are, the mountain-service, mountain-ash, quicken-tree, roan-tree (*S. aucuparia*); the true service, or forb (*S. domestica*); and the battard service, or mountain-ash (*S. hybrida*).

In the first sort the leaves make a pretty variety, when mixed with other trees in plantations: it is also handsome when in flower, and in the autumn, when in fruit; but the blackbirds and thrushes are so fond of it, that they devour it before it is well ripe.

In the second sort there are varieties in the fruit; as with apple-shaped fruit; with pear-shaped fruit; with oval fruit; with turbinated fruit; and with compressed fruit.

Method of Culture.—These plants are all capable of being raised from seed, and also by layers; but the first is the best method. The seeds, when well ripened in the autumn, should be sown on small beds of light fine ground in the nursery, either in drills or over the surface, covering them in to the depth of about an inch. When the plants rise in the following or second spring, they should be kept clear from weeds, and when of a year's growth, be planted out in nursery rows, to remain till of a proper size for planting out. But the second sort is sometimes sown in large pots, and forwarded in a hot-bed, so as to be sooner fit for planting out in nursery rows, as in one year, or a short space of time.

In the layer method, some of the best trees should be cut down near to the ground while young, by which shoots will soon be made and sent off, which should be laid down in the usual way in the autumn or spring seasons, where they readily strike root, and become proper for being planted out in nursery rows in about one year.

In order to continue any particular variety, this method must constantly be adopted. Also, in cultivating the second sort, for the purpose of fruit, the best method is by grafting or budding upon stocks of any of the sorts raised as above, or upon pear-stocks.

These trees, in rearing, should be trained for standards, each with a single upright stem, in the nursery, till from three to six or eight feet high, when they are proper for any plantation, and may be transplanted as required. And they may be introduced in any large shrubbery or other ornamental plantation, and in those of forest-trees. Some of the domestic service-tree sort may also be introduced as fruit-trees in gardens and orchards, principally as standards, but occasionally in espaliers, &c. in both of which modes they should be planted and managed as apple and pear-trees, permitting the standards to shoot freely above into full heads; the others being regulated according to their order of training. They will produce plentiful crops of fruit annually, after
some

some time, to gather in autumn. In gathering of which for the table, it is proper to lay some in the fruitery, or other place, a little time, to mellow and become soft and tender; in which state it is eatable, and of an agreeable taste and flavour.

Some of these sorts of trees, as the first and last kinds, are very ornamental in pleasure-ground plantations, and large shrubberies, both in their leaves and fruit. The other sort may also be occasionally introduced with good effect in particular situations.

SORCERER'S ISLAND, in *Geography*, a small island in the Atlantic, near the coast of Africa, where the Negroes come yearly to sacrifice to their deities, near the mouth of the Rio Grande.

SORCERY, the crime of witchcraft, or divination, by the assistance of evil spirits. See **MAGIC** and **MAGICIAN**.

Some hold forcibly to be properly what the ancients call *forti-legium*, or divination by means of *fortes*, or *lots*. Lord Coke, 3d Inst. fol. 44, describes a forcerer, *qui utitur fortibus, et incantationibus demonum*.

Sorcery is pretended to have been a thing formerly very common; at least the credulity of those ages made it pass for such; and people suffered frequently for it.

This supposed crime was made felony by 33 Hen. VIII. c. 8, and 1 Jac. I. c. 12; but this absurd law was very properly repealed by an act of George II. See **CONJURATION**.

SORCY, in *Geography*, a town of France, in the department of the Meuse, situated on the Meuse; 3 miles S.E. of Commercy.

SORDE, or **SORDES**, a town of France, in the department of the Landes, on the gulf of Oleron; 9 miles E. of Bayonne.

SORDES, a term applied to the matter discharged from ulcers in horses, when it is rather viscid or glutinous. This matter is frequently of a brownish-red colour, somewhat resembling the grounds of coffee, or grumous blood mixed with water. *Sordes, sanies*, and *ichor*, are all of them terms which imply a discharge much more fetid than purulent matter, and none of them are altogether free from acrimony; but that which is generally termed *ichor* is by much the most acrid of them, being frequently so sharp and corrosive, as to destroy large quantities of the neighbouring parts.

SORDINO, Ital., **SOURDINE**, Fr., a mute, or little machine placed on the bridge of a violin or violoncello to enfeeble or deaden the tone, by impeding the vibration of the whole instrument. The French never use this machine, and the Italians but seldom, at present.

SORDITIES, in *Surgery*, putrid pus of bad quality.

SORDUN, in *Geography*, a town of France, in the department of the Seine and Marne; 3 miles S.E. of Provins.

SORE, a town of France, in the department of the Landes, and chief place of a canton, in the district of Mont-de-Marsan; 27 miles N. of Mont-de-Marsan. The place contains 1450, and the canton 3409 inhabitants, on a territory of 420 kilometres, in 4 communes.

SORE, among *Sportsmen*, denotes a buck of the fourth year.

SOREL, a buck of the third year.

SOREL, in *Botany*. See **SORREL**.

SOREL, in *Geography*, a cape on the N. coast of the island of Jersey; 7 miles N.E. of St. Helier.

SORELLE, a town of Lower Canada, situated at the mouth of a river of the same name, which runs from lake Champlain into the St. Lawrence. It was laid out about

the year 1787, and on an extensive plan, with very wide streets, and a large square; but at present it contains only 100 houses, which are all very indifferent, and widely separated from one another. This is the only town on the St. Lawrence, between Montreal and Quebec, in which English is the predominant language. The inhabitants consist principally of loyalists from the United States, who took refuge in Canada. The chief business carried on here is that of ship-building; several vessels are annually launched from 50 to 200 tons burthen, which are floated down to Quebec, and there rigged. The river of Sorelle is deep at its mouth, and affords good shelter for ships from the ice, at the breaking up of winter: it is not navigable far beyond the town, even in boats, on account of the rapids; 24 miles N.N.E. from Montreal. Weld's Travels, vol. i.

SORENTO, or **SORRENTO**, a sea-port town of Naples, in Principato Citra, situated on the brink of the steep rocks that overhang the bay of the same name, and presenting an enchanting aspect. The mountains of Vico and Massa, between which it lies, shelter it from the W. and S. winds. Its streets are narrow; but this is no inconvenience in a warm climate, where carriages are not used, nor any communication with the metropolis practicable by land. Of all the places in the kingdom, this enjoys the most delightful climate, for which it was renowned in ancient times. Silius Italicus extols its soft and wholesome zephyrs: "Zephyro Sorentum molle salubri." At present it enjoys shady groves, excellent water, fruit, fish, milk, butter, the finest veal, the best wine, and every necessary of life at an easy rate. Its population consists of about 15,000 inhabitants, being half the population of the whole plain. These are goldsmiths, mariners, or fishermen. The women are employed in breeding silk-worms, and weaving the silk which they draw from them. It is an archiepiscopal see, of which the bishops of Stabia, Vico, Equeuse, and Massa, are suffragans. Some abbies are also subservient to it.

According to Hyginus, it was built by the Greeks; and was called Syrenetum, or Surenetum, from its having been the residence of the Syrens Leucosia and Ligia. However this be, it was anciently the abode of the Ofci, Opici, and Picientini, whose capital it was, and afterwards a Roman colony, and a municipal city, as we may conclude from a multitude of antique marbles. Its numerous ruins of edifices shew that the town is much reduced from its ancient state. It was formerly adorned with several magnificent temples, among which were those of Juno and Diana; but the most splendid of them was that built by Pollius, in honour of Hercules, and which Statius has depicted in all the charms of poetry. The place where this temple stood is now called corruptly Polo, and some traces are still seen of those of Ceres, Neptune, and Apollo. Besides the fruits and wines for which Sorrento is famous, it was also celebrated among the ancients for its beautiful earthen vessels, especially as goblets or drinking cups. Pliny very much applauds them, and Martial prefers them to those of the most valuable materials, and of the most exquisite workmanship. Sorrento values itself upon having been the birth-place of the celebrated grammarian L. Crassitius Pasides, mentioned by Suetonius in his treatise "De illustribus Grammaticis;" of the learned Bernardin Rota; and of the renowned Torquato Tasso; 15 miles S. of Naples. N. lat. 40° 40'. E. long. 14° 24'.

The bay of Sorrento is three miles wide: a semicircular chain of woody mountains incloses a rich and beautiful plain, rather sloping towards the sea, full of white buildings peeping out of the groves. This crescent terminates in a straight line to the sea, by a bold coast of black perpendicular

cular rocks. This probably formed a portion of a circle, half of which broke off and sunk into the waves, and probably the whole was once the crater of a volcano. The whole foil of the plain is cineritious, and its rocks consist of a strong blue lava, except near the east end, where they are of a softer piperino kind. The encircling mountains are composed of regular calcareous layers; and the materials of the lower ground are without doubt volcanical.

SOREX, or **SHREW**, in *Natural History*, a genus of the Mammalia Feræ class and order, of which the following is the generic character: there are two upper fore-teeth, which are long and bifid; the lower fore-teeth are from two to four; the intermediate ones are shorter; there are several tusks on each side; the grinders cuspidate. (See the article **SHREW**.) Seventeen species are enumerated in Gmelin's last edition of the Linnæan genera, which are as follow.

Species.

CRISTATUS; Crested Shrew. The nostrils in this species are carunculate; the tail is short. It inhabits North America. The whole animal is four inches long, and the tail an inch and a quarter: it feeds on roots, and resembles the mole in its face and snout.

MINUTUS; Minute Shrew. The snout of this species is very long, and it has no tail. It inhabits Siberia, in moist woods, under the roots of trees: it makes its nest of lichen, collects seeds, runs and burrows quickly; it bites, has the voice of a bat, and weighs about a drachm.

AQUATICUS; Aquatic Shrew. In this species the hind-feet are palmate; fore-feet are white; the tail is short and white. It is an inhabitant of North America, and is the size of a mole.

MOSCHIATUS. Feet palmate, tail flattened, thickest in the middle. This is called the musky shrew; it inhabits about the lakes of Volga and Tanais; burrows under the banks, with an entrance into the water; feeds on flags and fish; the body of the animal is seven inches long, and the tail is eight.

* **BICOLOR**; Water Shrew. The tail of this species is of the mean length; it is nakedish; the body is blackish, beneath it is cinereous; the toes are fringed. It inhabits Europe and Siberia, near swamps and rivers; swims easily, often under water: the female has ten teats, and brings forth nine young at a time; it makes a noise like the chirp of a grasshopper; the body of the animal is four inches long, and the tail two.

MURINUS; Murine Shrew. The tail is of a middle length; the body is brown, feet and tail cinereous. It inhabits Java, and is the size of a mouse.

* **ARANEUS**; Fetid Shrew. The tail of this species is of the middle length; the body beneath is whitish. It inhabits almost every part of Europe, and in the northern climates of Asia; it lives in old walls, stables, yards, granaries, out-houses, swamps, and pools; it feeds on corn and insects; it smells of musk; is killed, but not eaten, by cats; the voice is shrill; it runs much slower than a mouse; brings five or six young ones in spring and summer; it is seldom so long as three inches. There are two varieties. 1. Head, and upper parts, dusky; sides brownish rusty. This is found in Hudson's Bay and Labrador. 2. The upper parts are of a dusky grey, and underneath the animal is of a yellowish-white.

SURINAMENSIS; Surinam Shrew. The tail of this species is half as long as the body; the body above is chestnut, beneath white and yellowish-grey. It is found, as its specific name denotes, at Surinam.

PUSILLUS; Timid Shrew. Ears rounded; tail short, a

little fringed at the sides. It inhabits the northern parts of Persia, in holes which it burrows; it is three inches and a half long; the body is of a dark grey above, and the belly is paler.

BRASILIENSIS. The body of this species is brown, the back is black, with three stripes. It inhabits Brazil, is about five inches long, with a tail of two inches in length.

EXILIS. The tail of this is very thick in the middle, tapering to each end. It inhabits Siberia; it is the smallest of quadrupeds, scarcely weighing half a drachm; it is like, though of a darker colour, the *S. araneus*.

CÆRULEUS; Blue Shrew. The tail is of a mean length; the upper parts are of a pale blue; the belly is lighter; the legs and feet are white. It inhabits Java, and the other East Indian islands, feeds on rice, smells strongly of musk, is eight inches long, with a tail about half that length.

MEXICANUS; Mexican Shrew. The tail is short; the fore-feet are three-toed; the hind-feet have four toes. It is found in New Spain; burrows in vast numbers, feeds on roots and seeds; the flesh is good; it is about nine inches long.

ALBIPES; White-footed Shrew. Tail slender, hairy; upper parts dusky-ash; feet, belly, and teeth, white.

QUADRI-CAUDATUS; Square-tailed Shrew. The tail, as its specific name denotes, is squarish; the head and upper parts are of a dusky-ash; the belly is paler; the fore-teeth are brown.

LURI-CAUDATUS; Carinate Shrew. The tail is taper, keeled underneath; head and upper parts dusky-ash, belly whitish; fore-teeth brown, a white spot behind each eye.

UNICOLOR. The tail is compressed at the base; the body is of an uniform dusky-ash. It is observed by Gmelin, that the last four, described as distinct species, are probably only varieties of the *S. araneus*. They are all found near Strasburg.

SOREY, in *Geography*, a town of France, in the department of the Meuse; 3 miles S.S.E. of Commercy.

SOREZE, a town of France, in the department of the Tarn; 12 miles S.S.W. of Castres.

SORG, a town of Germany, in the principality of Anspach, on the Schwarzach; 8 miles E. of Schwabach.

SORGANO, a town of the island of Sardinia; 38 miles E. of Bofa.

SORGE, **GEORGE ANDREAS**, in *Biography*, a voluminous writer on music, and a composer, born in 1703, and who died in 1778. In Gerber there is a list of his works.

SORGENFREY, or **SANS SOUCI**, in *Geography*, a town of Denmark, in the island of Zealand, with a royal palace; 6 miles N. of Copenhagen.

SORGHUM, in *Botany*, a name of oriental or barbarous origin, but venerable for its antiquity.—“*Perf. Ench. v. 1. 101.*” *Pursh v. 1. 78.* (*Sorghum*; *Mich. Gen. 35.* *Mieg. Aët. Helvet. v. 8. 131.* *Holcus*; *Brown Prodr. Nov. Holl. v. 1. 198.*)—Class and order, *Triandria Digynia*. *Nat. Ord. Gramina.*

Gen. Ch. Cal. Glume of two ovate, concave, coriaceous, unequal valves, inflexed at the margin, single-flowered. *Cor.* of two membranous, ovato-lanceolate, rather unequal valves, hairy at the edges; the innermost rather the smallest, cloven, bearing from its fissure a twisted awn, twice the length of the glume itself. *Nectary* a thin, awl-shaped, villous scale. *Stam.* Filaments three, capillary; anthers cloven at each end, prominent. *Pist.* Germen ovate, polished; styles two, capillary, short, spreading; stigmas oblong, feathery. Some flowers, elevated on stalks, have neither awn nor pistil. *Peric.* none, except the permanent, hardened, closed calyx. *Seed* solitary,

solitary, oval, tumid, concealed in the hard polished calyx, out of which the awn of the corolla projects.

Eff. Ch. Calyx of two valves, single-flowered. Corolla of two valves; the inner one cloven and awned. Nectary villous. Seed enclosed in the hardened calyx. Some flowers male, stalked, without an awn.

We have under the article *HOLCUS* adverted to the present genus, which requires to be separated therefrom, and is in itself important, on account of its economical uses. What are its genuine species, we do not completely undertake to determine, nor how far those which are described are distinct, authors having been obliged to recur to *colour* in their definitions. "They are annual grasses, of quick growth, and of a very large bulk, abounding with saccharine juice, as much as the sugar-cane, at least in Italy." Professor Arduino shewed the writer of this, at Padua in 1787, good sugar and treacle procured from his *Holcus Cafer*, hereafter mentioned. See Sm. Tour on the Continent, ed. 2. v. 3. 10. The stalks of the ripe panicles of some of the species make brooms, or even carpet and clothes-brushes of a very good quality. The following will serve to exemplify the genus in question.

S. Dora. Common Indian-millet. (*Holcus Dora*; Mieg. Act. Helvet. v. 8. 125. t. 4. f. 3. *Holcus Sorghum*; Linn. Sp. Pl. 1484. Willd. Sp. Pl. v. 4. 929. Ait. Hort. Kew. v. 5. 430. Arduin. Olc. o Sorg. 19. t. 4. f. 1. *Milium indicum*; Matth. Valgr. v. 1. 370.)—Panicle ovate, compact, erect. Glumes downy. Seeds slightly compressed.—Native of the East Indies. Cultivated in the south of Europe. The root is annual, consisting of innumerable fibres. *Stem* erect, round, jointed, leafy, from six to ten feet high, as thick as the finger or thumb. *Leaves* sheathing, reed-like, lanceolate, smooth, with a strong mid-rib, and many fine lateral, oblique, parallel ones. *Panicle* terminal, from four to twelve inches long, very much branched, close, of innumerable downy flowers, on zig-zag or curved stalks. *Seeds* roundish, various in colour, usually yellow or reddish. This is the most general species, under which indeed many of the rest have been confounded; but some of them, by their superior merits, have superseded it in cultivation.

S. bicolor. Two-coloured Indian-millet. (*Holcus bicolor*; Linn. Mant. 301. Willd. Sp. Pl. v. 4. 929. Ait. Hort. Kew. v. 5. 430. Arduin. Olc. o Sorg. 29. t. 6. H. Sorghum; Mieg. Act. Helvet. v. 8. 129. t. 4. f. 4?)—Panicle erect, somewhat lobed. Glumes smooth, black. Seeds globose, white.—Said to be a native of Persia. Sufficiently distinct from the former, by the above characters.

S. cernuum. Drooping Indian-millet. (*Holcus cernuum*; Willd. Sp. Pl. v. 4. 930. Arduin. Olc. o Sorg. 14. t. 3. f. 1, 2.)—Panicle compact, curved downward as it ripens. Glumes downy. Seeds globose.—Cultivated in Arabia, Syria, and various parts of the Levant, being probably a native of India. It is remarkable for its deflexed, or pendulous panicle of seed, whose stalk cannot be made straight without breaking. The stem is five or six feet high. Leaves smooth. Seeds very white, scarcely compressed.

S. caffrorum. Caffres Indian-millet. (*Holcus caffrorum*; Thunb. Prodr. 20. Willd. Sp. Pl. v. 4. 930. H. Cafer; Arduin. Olc. o Sorg. 5. t. 1.)—Branches of the panicle spreading every way, deflexed. Glumes downy. Awns deciduous. Seeds globose.—Native of the Cape of Good Hope. Rather larger than most of the preceding, with a spreading, drooping-branched panicle. Seeds more exposed than in the others. Professor Arduino recommends this much for culture, on account of its abundant crop; the goodness of the grain for poultry; and the copious sac-

charine juices of the stems. We perfume his plant and Thunberg's to be the same, but have no proof.

S. saccharatum. Yellow-seeded Indian-millet. Pursh n. 1. (*Holcus saccharatus*; Linn. Sp. Pl. 1484. Willd. Sp. Pl. v. 4. 930. Ait. Hort. Kew. v. 5. 430. Arduin. Olc. o Sorg. 22. t. 4. f. 2. Mieg. Act. Helvet. v. 8. 119. t. 4. f. 1. Sorghum; Rumph. Amboin. v. 5. 194. t. 75. f. 1.)—Panicle erect, with slender, drooping, lax branches. Glumes hairy. Male flowers very few, withering.—Native of the East Indies. The more dispersed flowers, on the long, spreading, drooping, whorled branches of the panicle, readily mark this species.

S. nigrum. Coal-black Indian-millet. (*Holcus niger*; Arduin. Olc. o Sorg. 20. t. 9.)—Panicle ovate, erect, with spreading dense branches. Glumes and seeds black.—Nothing is said of the native country, or particular qualities, of this species, which is one of the largest of the genus. The leaves are long and broad, conspicuous for their white rib. Panicle somewhat pyramidal, not near so dense as that of the first species, but the flowers are thickly set on its spreading, slightly deflexed, branches.

SORGUE, or *Pont de Sorgue*, in *Geography*, a town of France, on the river Sorgue; 6 miles from Avignon.—Also, a river of France, which rises from the fountain of Vaucluse, and runs into the Rhone, by several mouths, at and near Avignon.

SORI, a town of the Ligurian republic; 9 miles S.E. of Genoa.

SORIA, a town of Spain, in Old Castile, near the source of the Duero, built near the ruins of the ancient Numantia. This town, which suffered much during the Moorish wars, was repopled in the beginning of the 12th century, by order of Alonso, king of Castile; 116 miles N.N.E. of Madrid. N. lat. 41° 47'. W. long. 2° 35'.

SORIAN, a river on the W. coast of the island of Celebes, which runs into the sea, S. lat. 3° 9'. E. long. 119° 48'.

SORIANO, FRANCESCO, in *Biography*, a great canonist, and critic of the music of his time, was maestro di cappella of St. Peter's church at Rome, and in 1610 published one hundred and ten canons upon the chant to the hymn "Ave Maris Stella," for three, four, five, six, seven, and eight voices. Refolutions of these canons in score, with remarks, by Zacconi, 1625, in manuscript, were in the possession of the late respectable theorist and historian, P. Martini, who, among his other musical curiosities, communicated to us this manuscript, which impressed us with a much higher opinion of the patience than the genius of Soriano. Few masters, except himself, could perhaps have composed these canons, but many must have thought that the loss to music would not have been very great, if they had never been composed. Baptist Doni, an enemy to learned music, and a great advocate for the recitative and melodies for a single voice, which were now advancing into favour, says (Tratt. della Mus. Scenica, Op. omn. tom. ii. p. 129.) that though Soriano was generally allowed by musicians to be a learned contrapuntist, he never had genius sufficient to invent a single air that was beautiful or pleasing; on which account he applied himself to the composition of elaborate fugues and canons: as in poetry, those who have no original ideas or invention can write acrostics and anagrams, by which they become only rhymers, not poets; so canonists should be called contrapuntists, not musicians.

SORIANO, in *Geography*, a town of the Patrimonio; 6 miles E.S.E. of Viterbo.—Also, a town of Naples, in Calabria Ultra; 6 miles E.S.E. of Mileto.

SORIBOA, a town of Peru, in the diocefe of Truxillo, and jurifdiction of Chacapoyas.

SORICINA, a town of Italy, in the department of the Upper Po; 12 miles N. of Cremona.

SORIGO, a town of Italy, in the department of the Lario; 27 miles N. of Como.

SORIN, a river of France, which runs into the Rhone, at Roanne.

SORITES, Σωρητις, formed from σωρη, *cumulus*, *heap*, in *Rhetoric*, &c. a kind of argument, in which feveral middle terms are chofen to connect one another fucceffively in feveral propofitions, till the laft propofition connects its predicate with the firft fubject. Whence Cicero calls it *fylogifmus acervatus*, an *accumulative fylogifm*.

Such was that merry argument of Themiftocles, to prove, that his little fon, under ten years old, governed the whole world. Thus: "My fon governs his mother; his mother me; I the Athenians; the Athenians the Greeks; Greece commands Europe; Europe the whole world: therefore my fon commands the whole world."

This method of difputing prevailed much among the Stoics; efpecially with Zeno and Chryfippus; but it is very fophiftical.

SORITO, in *Geography*, a town of Naples, in Calabria Ultra; 5 miles E.S.E. of Mileto.

SORIVA, a town of Italy, in the Feltrin; 6 miles W. of Feltri.

SORKEY, a town of Hindooftan, in Bahar; 15 miles W. of Rotafgur.

SORLECHEU, a town of France, in the department of the Jemappe; 6 miles E.N.E. of Avesnes.

SORNAC, a town of France, in the department of the Correze, and chief place of a canton, in the diftrict of Uffel. The place contains 1453, and the canton 5647 inhabitants, on a territory of 205 kilometres, in 8 communes.

SORNI, a name given by fome of the chemical writers to iron.

SORNZIG, in *Geography*, a town of Saxony, in the circle of Leipfic; 3 miles S. of Mugeln.

SORO, a river of Portugal, which runs into the Tagus, near Salvaterra, in the province of Eltremadura.

SOROCEPHALUS, in *Botany*, fo named by Mr. Brown, from σωρος, a *heap*, and κεφαλη, the *head*, alluding to the aggregate, or crowded, heads of flowers.—Brown Tr. of Linn. Soc. v. 10. 139. Ait. Hort. Kew. v. 1. 202.—Clafs and order, *Tetrandria Monogynia*. Nat. Ord. *Proteaceae*, Juff. Brown.

Eff. Ch. Corolla four-cleft, regular. Stamens in the concave tips of the fegments. Nectary four fcales beneath the germen. Stigma vertical. Nut fuperior. Involucrum of from three to fix leaves, permanent, containing one, or a very few, flowers. Common receptacle naked.

Shrubs, with wand-like branches. Leaves fcattered; either thread-shaped or flat, undivided; the loweft only being occasionally bipinnatifid. Involucrum nearly feffile, with a folitary braetea, collected into a capitate terminal fpike, fometimes fubtended by imbricated braeteas. Flowers purplifh. *Brown*.

Mr. Brown defcribes eight fpecies, all natives of fouthern Africa. Two are in the Englifh gardens.

Section 1. *Spike nearly naked. Involucrum from one to three-flowered. Nut entire at the bafe, on a very fhort falk. Leaves thread-shaped, undivided.*

1. *S. fetaceus*. Brittle-leaved Sorocephalus. Br. n. 1.—"Involucrum fingle-flowered. Leaves fetaceous, incurved, hairy, as well as the branches."—Gathered by Dr. Roxburgh, at the Cape of Good Hope. An erect *shrub*, with

ftaight umbellate *branches*. *Leaves* numerous, an inch, or rather more, in length, with a briftly faded point; the lower ones lefs incurved. *Head* terminal, feffile, ovate; the fize of a black cherry. Lower part of the *corolla* loofely downy; its fegments bearded. *Stigma* ovate, fomewhat conical.

2. *S. falfoloides*. Salt-wort Sorocephalus. Br. n. 2.—"Involucrum fingle-flowered. Leaves triangular-thread-shaped, incurved, fmoother."—From the fame country. *Roxburgh*. Erect, very much branched. Youngeft *branches* finely downy. *Leaves* half an inch long, furrowed above, with an acute point, nearly of their own colour. *Head* rather fmall than the former, accompanied underneath by a few minute lanceolate *braeteas*. *Corolla* bearded with fhort hairs. *Stigma* erect, or flightly inclined.

3. *S. imberbis*. Beardlefs Sorocephalus. Br. n. 3.—"Involucrum three-flowered. Segments of the corolla, as well as the points of the braeteas, fmoother."—Gathered by Mr. Niven, near the Cape of Good Hope. Much branched; the young *branches* downy. *Leaves* fmoother, an inch long, moderately fpreading, fcarcely incurved, fsharp-pointed; furrowed above. *Head* on a fhort falk, terminal, nearly globofe, the fize of the firft fpecies. *Braeteas* lanceolate, fringed, with a fmoother awl-shaped point. Lower part of the *corolla* bearded. *Style* ftraight. *Stigma* club-shaped, equal.

4. *S. spatuloides*. Curve-ftyled Sorocephalus. Br. n. 4.—"Involucrum three-flowered, fomewhat stalked. Segments of the corolla bearded."—Found by Mr. Niven, near Franche-hoek, at the Cape of Good Hope. An upright *shrub*, with umbellate, finely downy, *branches*. *Leaves* fcarcely an inch long, moderately fpreading; hairy when young. *Heads* either folitary, or two or three together, ovate or oblong, the fize of a hazel-nut, on fhort falks. *Braeteas* lanceolate, acute, downy; fometimes fmoother at the point. *Corolla* bearded with long hairs. *Style* generally incurved at the point, in which cafe the *stigma* is fomewhat unequal; but if the *style* be nearly ftraight, it is ovate and equilateral.

Section 2. *Spike with more or lefs of a general involucrum. Partial involucrum with from four to fix flowers. Nut emarginate at the bafe.*

5. *S. tenuifolius*. Slender-leaved Sorocephalus. Br. n. 5.—"Leaves thread-shaped, very fhort. Heads of few flowers. Corolla with a feathery beard; its innermoft fegment nearly naked."—Gathered by Mr. Niven, in moift fituations near Breed river, at the Cape of Good Hope. A *shrub* three or four feet high, with fmoother, reddifh, leafy *branches*; fomewhat villous when young. *Leaves* imbricated, roughifh, fsharp-pointed, not half an inch long; the younger ones hairy. Aggregate *head* terminal, feffile, the fize of a pea, compofed of from two to four partial *heads*. *Partial involucrum* fomewhat imbricated; their leaflets lanceolate, bearded, fmoother at the points. *Corolla* very deeply four-cleft, equal. *Style* ftraight. *Stigma* ovate, erect, equilateral.

6. *S. lanatus*. Woolly Sorocephalus. Br. n. 6. Ait. n. 1. (*Protea lanata*; Thunb. Diff. n. 30. t. 3. Willd. Sp. Pl. v. 1. 519.)—Leaves triangular-thread-shaped; furrowed above. Heads of many flowers. All the fegments of the corolla with feathery beards.—Native of Swartland, and other mountainous tracts, about the Cape of Good Hope. Sent to Kew garden, by Mr. Maffon, in 1790. It flowers from June to September. An upright *shrub*, with fomewhat umbellate, ftraight, leafy, minutely downy *branches*. *Leaves* imbricated, from five to eight lines long. *Head* the fize of a large hazel-nut, feffile, globofe, folitary; the partial ones very clofely crowded; each of from five to eight flowers.

flowers. *Involucrum* of from five to seven narrow-lanceolate bearded leaves. *Corolla* equal, deeply divided. *Style* straight, with a thick equilateral *stigma*. *Nut* finely downy, with a thin, brown, slightly rugged, shell; its stalk very short. The *leaves* are occasionally roughish or smooth, their keel rounded or acute.

7. *S. imbricatus*. Imbricated Sorocephalus. Br. n. 7. Ait. n. 2. (*Protea imbricata*; Thunb. Diss. n. 45. t. 5. Linn. Suppl. 116. Willd. Sp. Pl. v. 1. 527. Andr. Repof. t. 517.—Leaves lanceolate; rough underneath. Base of the corolla clothed with glandular hairs. *Stigma* club-shaped.—Found on hills at the Cape of Good Hope. Sent to Kew, by Mr. Masson, in 1794. Mr. Hibbert also obtained it from his collector there, Mr. Niven. This has the habit of the foregoing, but the *leaves* are lanceolate, near an inch long; hairy beneath, and at the edges; smooth above. *Head* sessile, ovate or oblong, either solitary, or composed of two or three crowded together; with a common *involucrum*, of many lanceolate coloured leaves. Each partial *involucrum*, of four lanceolate hairy leaves, usually contains four flowers. *Corolla* slender, purplish; its segments bearded, with a long dense tuft of white hairs, as is likewise the *germen*. *Style* straight. *Stigma* a little gibbous. *Nut* oblong, brown, very smooth and shining.

8. *S. diversifolius*. Various-leaved Sorocephalus. Br. n. 8.—“Leaves spatulate-lanceolate; smooth underneath; the lowermost doubly pinnatifid. *Corolla* bearded throughout. *Stigma* cylindrical.”—Gathered by Mr. Niven, on stony hills near *Goud Rivier*, at the Cape of Good Hope. A smooth *shrub*, whose *stem* is from two to six feet high, either simple or divided, straight, erect, as thick as a swan's quill; downy in the upper part. *Lower leaves* two inches long, twice three-cleft, channelled; the rest imbricated, bluntish, scarcely concave, hardly half an inch in length. *Head* sessile, solitary, ovate, obtuse, the size of a small plum.

SOROCHINSKAIA, in *Geography*, a fortress of Russia, in the government of Upha, on the Samara; 80 miles N.W. of Orenburg.

SOROE, a town of Denmark, in the island of Zealand, surrounded by three fresh-water lakes. In this place is a royal academy, endowed with the revenues of a rich convent, which was dissolved at the revolution; 35 miles S.W. of Copenhagen. N. lat. $55^{\circ} 27'$. E. long. $11^{\circ} 30'$.—Also, a small island in the North sea, near the coast of Norway. N. lat. $70^{\circ} 30'$.

SOROOMAN, a town of Arabia, in the province of Oman; 110 miles S.W. of Julfa.

SOROTO, a town of Thibet; 70 miles W.N.W. of Cha-tehou.

SORRANCES, among *Farriers*, signify two things; viz. either an ill state, or habit, of a horse's body, arising from some part diseased; or a loosening and solution of the continuity of the parts; which, according to the various circumstances of it, acquire new names, as fracture, wound, ulcer, rupture, convulsion, cramp, excoriation, &c.

SORRANCE-WATER, a name given by our farriers to a solution of vitriol, and some other ingredients, in vinegar; a medicine much esteemed in many of the diseases of horses. It is prepared in the following manner.

Take Roman vitriol, and roach-alum, of each an ounce and a half; verdigris, an ounce; copperas, two ounces: reduce all these to powder together, and put them into a two-quart bottle, into which pour a quart of the strongest and best wine-vinegar; this is to be set in balneo Mariæ. The short way of doing which by the farrier, is this: he

puts a wisp of hay into the bottom of the kettle, and then tying some pieces of lead or iron about the neck of the bottle, to make it heavy enough to sink in water, it is set upon the hay so, as to stand very upright; then three notches are cut lengthwise in the cork to give passage to some of the vapours when the bottle is heated, that it may not burst. When every thing is thus prepared, so much cold water is to be put into the kettle, that the neck of the bottle may stand two or three inches above it; the kettle is then to be set over the fire, and the water is to be made to boil, and kept boiling about half an hour, the bottle being at times taken out, and thoroughly shaken. When the salts are thus thoroughly dissolved in the vinegar, the whole is to be kept for use.

The method in which they use it is this: take an earthen pan, which will hold about twelve quarts; let this be filled with urine that has been made by sound, healthy, and young persons; the staler the urine is, the better it is for use, and it ought indeed always to stand, at least, three weeks before it is used. It is proper for the farrier, therefore, always to keep a quantity of this ready, and when the water is to be used, half a pint of it is to be mixed with a quart of the urine; or, if it be required stronger, more of the water is to be added: these are to be thoroughly mixed together, and the legs, or other affected part of the horse, bathed with it with soft rags twice a-day.

The virtues of this water are highly extolled: it is said to cure the malanders in two or three times dressing; it is also a sovereign remedy for the mange, either dry or wet, and for the rat-tails, scratches, goured or swelled legs and heels, and it also cures horses when the greafe is fallen into their heels, as the farriers express it. The farcy is also said to be often cured by a long continuance in the use of it, purging the horse two or three times, at different distances of time, during the time of his being under cure by the water. They also find it a good cleanser and healer of foul ulcers, and that it prevents the breeding of proud-flesh and worms in wounds, and drives away a flux of humours that were falling upon any part. They use it also in clefts and cracks of the heels, and in windgalls, especially in the prevention of the lall, by its repellent qualities. The green water alone is an excellent remedy for filulas, cankers, and the galled backs of horses; disposing such sores, as they are called, not to fester, rot, and grow worse, as all greasy and oily medicines do, but cleansing them, and preparing the way to a very sound and standing cure.

SORREL, ACETOSA, in *Botany*, *Gardening*, and the *Materia Medica*. See RUMEX.

SORRELS, *Indian Red*, and *Indian White*, or *Syrian Mal-low*, in *Botany*, are species of *Hibiscus*; which see.

SORREL, *Wood*, in *Botany*, *Gardening*, and the *Materia Medica*. See OXALIS.

SORREL, *Common* and *Curled*, in *Agriculture*, troublesome weeds in meadows and pasture lands; also the latter in cultivated arable ground, where neither horses nor neat cattle will eat it, which, of course, renders it necessary to be eradicated. This is mostly accomplished by rooting it out, or frequently cutting the stalks over just below the surface of the land. It has often the title of curled dock. See WEEDS.

SORREL, in the *Manege*, is used for a reddish colour. The mane ought to be red or white, in a horse of this colour. It is distinguished, according to the degrees of its deepness, into a *burnt sorrel*, and a *bright* or *light sorrel*. Generally speaking, it is a sign of a good horse.

SORREL, *Salt of*, in *Chemistry*, the native super-oxalat of potash,

potash, contained in the juice of this plant. See *OXALIC Acid*.

SORREL-Tree, in *Botany*. See *ANDROMEDA*.

SORRO, in *Geography*, a town of Africa, in Beeroo; 85 miles S.W. of Walet.

SORROINSU, a town of the department of Liamone, or island of Corfica; the canton of which contains 1528 inhabitants.

SORS, a town of the island of Sardinia; 10 miles N.N.E. of Saffari.

SORSELE, a town of Swedish Lapland, in the lap-mark of Pitea; 105 miles W. of Pitea. N. lat. $65^{\circ} 33'$. E. long. $17^{\circ} 20'$.

SORSOKEN, a sea-port town in the S.E. part of the island of Lugon.

SORT, a town of Spain, in the province of Catalonia; 18 miles W. of Urgel.—Also, a sea-port town of Africa, in the country of Tripoli, situated on the coast of the Mediterranean, in the gulf of Sidra. N. lat. $30^{\circ} 28'$. E. long. $16^{\circ} 55'$.

SORTES, *LOTS*, in *Antiquity*, a method of deciding dubious cases, where there appears no ground for a preference; by referring the decision to chance; as in casting of dice, drawing of tickets, &c.

The fortes, or lots, were of ancient use among the Jews; and in the books of the Old Testament we meet with divers standing and perpetual laws, and divers particular commands, prescribing and regulating the use of them. Thus, the Scripture informs us, that the lot fell on St. Matthias, when a successor to Judas in the apostolate was to be chosen. Our Saviour's garment itself was cast lots for.

The *SORTES Prænestinae* were famous among the Greeks. The method of these was to put a great number of letters, or even whole words, into an urn; to shake them together, and throw them out; and whatever should chance to be made out in the arrangement of the letters, &c. composed the answer of this oracle.

Cicero, de *Divin.* lib. ii. § 41, says, that a variety of predictions were inscribed on pieces of wood, which were kept in a box or chest; and one of these drawn out by a child, after the box was shaken, contained the answer sought. He also informs us, how these fragments of wood were first discovered; but he observes, "Tota res est inventa fallaciis, aut ad quæstum, aut ad superstitionem." In lieu of this, another kind of fortes was introduced into Greece and Italy; which was, to take some celebrated poet, as Homer, Euripides, or Virgil, to open the book, and whatever first presented itself to the eye upon opening, was taken for the ordinance of heaven. This made what they called the *fortes Homericae*, and *fortes Virgiliana*; which succeeded to the use of the *fortes Prænestinae*.

The bath *kol* among the Jews was much of the same kind, differing only in this circumstance, that the Jews took their oracle from the first words which they heard any body pronounce; the Heathen, from the first they cast their eyes upon, on opening Homer, &c. in which they endeavoured to discover a meaning suitable to the matter concerning which they inquired.

This superstition passed from Paganism into Christianity; and the Christians took their fortes out of the books of the Old and New Testament. The first passage that presented itself upon opening a book of Scripture, was esteemed the answer of God himself.

If the first passage did not happen to be any thing to the purpose for which the fortes were consulted, another book was opened; till a passage was met with that might be taken for an answer. This was called *fortes sanctorum*.

St. Augustine (Epist. ad. Jan. 109.) does not disapprove of this method of learning futurity, provided it be not used for worldly purposes.

Gregory of Tours adds, that the custom was first to lay the Bible on the altar, and to pray the Lord, that he would discover by it what was to come to pass. Instances of the use of the fortes sanctorum are very frequent in history. Heraclius, M. Fleury tells us, in his war against Chosroes, to learn where he should take up his winter-quarters, purified his army for three days, and then opened the Gospels, and found the place appointed for his winter-quarters was in Albania.

Gilbert of Nogent informs us, that, in his time, (that is, about the beginning of the 12th century,) the custom was, at the consecration of bishops, to consult the fortes sanctorum, to learn the success, fate, &c. of their episcopate.

The practice is founded on a supposition, that God presides over the fortes, and on Prov. xvi. 33. "The lot is cast into the lap; but the disposing thereof is of the Lord."

In effect, many divines hold that the lot is conducted in a particular manner by Providence; that it is an extraordinary manner in which God declares his will by a kind of immediate revelation. The fortes sanctorum, however, were condemned by the council of Agda, in 506, at the time they were beginning to take footing in France, &c.

SORTILEGE, *SORTILEGIUM*, a kind of divination by fortes, or lots.

SORTING Sheep-Stock, in *Agriculture*, the practice of carefully choosing, sorting, collecting, and putting together, those which are the most proper and best suited for the purpose of breeding, or any other use that may be in the contemplation of the grazing farmer. It is a practice which has hitherto, for the most part, only prevailed among the larger and better kinds of sheep-farmers, but which ought to be every where attended to where good sheep-stock is wanted, and good management with them to be pursued. It, however, requires great care and attention in the execution, in order to perform it in a proper manner; but, when well conducted, amply repays the judgment and skill of the stock-farmer. The proper introduction of new and approved breeds has done much in bettering this sort of stock, by promoting a more spirited attention to the subject, and inculcating the necessity of a more careful selection; as, since this has been the case, very evident improvements have taken place in the forms and dispositions of sheep, as well as in the quality of their wool.

The utmost care and attention are constantly demanded in the selection of such sheep as are to be bred from; and as it would require a great length of time to correct and remove the errors and bad consequences that might arise from any neglect in so important and essential a matter, the sheep-master should always himself be, as much as possible, employed in the business. He should take care that the ewe teags, or young ewes, be very fully and strictly examined in the mouths, to see that they are not chopped or defective in such parts; their make should be seen to be proper and handsome in all points, and their wool of a superior quality; the staple being well suited to the pasture or nature of the keep, rather short than long, as short wool is commonly thick, and kindly for the sheep; but when too long, it is apt to be thin, and to draw too much nourishment from the animal, without affording the necessary warmth and protection in the winter season. These sorts of sheep should in all cases be sorted down, or refused, as it is called, in a very close manner; and when there are not more than are wanting to put the ram to, and many of these are defective, all such should be fattened or sold, and their places supplied by the best

best of the old ewe-stock, which would otherwise be sent away. This is not generally practised, but it is evident that a well-formed or perfect old ewe must be better for breeding from, than such young ones as are ill-formed or imperfect in their shape.

There are different periods for the sorting or selecting of sheep-stock; as the time when the ewes are arranged and put into different classes for the rams, the season of lambing, &c.: in each of which, the defects and imperfections of them may be discovered without much difficulty. But the most proper time of all, according to some, is in the early spring, as about the beginning of March, as then the soft, the long, the coarse wool, and all other imperfections in the ewes, are the most conspicuous, and readily detected, and those of the best forms, qualities, and dispositions, may be the most fitly drawn off and preserved; as such sheep as are capable of supporting themselves, and of looking well under the difficulties of a severe winter season, must in general be the most deserving of the breeding sheep-farmer's attention; while such as have wintered badly will not unfrequently shew a good disposition in the summer season. In these cases, where imperfections are discovered, the sheep should either be drawn off, put out, and lambed by themselves, or a private mark set upon them; and the ewes and lambs sold or made fat. Thus, the number of bad ill-formed sheep, that ought not to be kept, are conveniently reduced and completely got rid of, which, if they or their lambs were suffered to blend and intermix with the well-formed sheep, the stock would be in danger of being contaminated. It is the common practice in most cases, to only select or sort the sheep once in the year; but with good managers they are had under hand two or three times in the same space of time; and whenever a sheep is seen with any sort of defect, it is immediately marked, and sent to be made fat.

Many make this sorting, or inspection, so late as the beginning of the autumn, but an earlier performance of the business is evidently preferable, in order that the defective stock may be put to fatten in proper time.

The manner of performing the business is commonly by pouncing the sheep in a small number at a time, so that the sheep-farmer may be able to examine them at once, without the danger of being distracted or confused by having too many exposed to his view, and consequently be incapable of distinguishing the properties of their forms, and other qualities which ought to be particularly attended to in forming his decision. In the execution of this work, the farmer, his shepherd, or looker, are provided with ochre, or some other material, for giving the defective sheep the usual private mark, in order that they may be known from the perfect part of the flock, and be disposed of accordingly. This marking, or *tivering*, as it is called in some places, is performed differently, according to circumstances, as the purposes the sheep are to be put to, and the number of lambs the ewes have had. It is well done sometimes also to have the sheep marked with pitch, according to their ages. See *TIVERING*.

The defects which are chiefly to be taken notice of in the sorting of sheep in this intention, are those of bad shape, as the head being thick or too long, the body too long and narrow, without sufficient roundness, the feet and bones too large, the chest too much confined, the want of straightness in the back, too great a length in the legs and neck, the sheep being too large for the pasture or keep, their not handling in a proper manner, the wool bad, as too coarse or too long and picky, or coming off, waxy, or hempy, the sheep being lousy, struck with the fly, gally,

thick pelted, and scurvy, their being hog-chopped, that is, having the lower jaw shorter than the upper one, by which their feeding properly is prevented, the mouths large, causing the loss of the cud in rechewing their food, &c. By sorting and selecting sheep as free as possible from defects of these kinds, the best sheep-stock may be procured, provided the true form be properly understood and constantly kept in mind, without suffering it to be injured in any way by the admission of improper qualities at any time, or under any circumstances.

The sorting or selection of sheep in this intention, may perhaps be a little different in different cases; but wherever a good stock is aimed at, the breeding sheep-farmer should of course select that breed, whatever it may be, which is most suited to his circumstances and purposes, and which the most nearly approaches towards the state of perfection in its form and other properties, or which possesses that particular kind of improvement which he is in want of, being constantly well aware what constitutes such states in the animal. The parts of his stock which are deficient, or do not fully come up to or possess such properties, are always to be sorted out and rejected, being sold or turned off for the purpose of fattening, both in the ewes and the lambs, as they might be in danger of accidentally injuring the flock. Good breeding sheep-farmers are also at all times closely on the watch to have none but those of superior qualities, and to take advantage of any accidental improved variety which may answer their intentions. The full proper culling or selecting and sorting of the younger part of the ewe-stock, is in all cases a material point in having good sheep-stock, and one which is never to be neglected. The careful breeder should indeed continually have his eyes upon his flock, to see that there are no faulty animals continued in it, especially in any material degree, as much may be effected in this way, and the trouble of sorting be considerably lessened. See *BREEDING, LIVE-STOCK, and SHEEP*.

The practice of sorting sheep is not, however, useful only for the purpose of breeding, but may be beneficially employed in other intentions. The sorting of sheep, according to their ages, sizes, kinds, and other qualities, is often highly important and advantageous in the stocking of pasture lands, as it enables the sheep-farmer to do it with greater propriety and correctness, as well as with a greater profit in the improvement of the stock. See *STOCKING Pasture Land*.

Sheep are likewise sorted with very much benefit for the different purposes of store-feeding, lambing, fattening, and other sorts of management with them.

But however beneficial the practice may be in these several intentions, as well as in some others, it is probable that it has hitherto been attempted only in a few instances, and in many of those in much too slight and inattentive a manner; it is, notwithstanding, of the utmost necessity and importance in the management of this sort of live-stock, and when once well understood and properly performed, cannot fail of producing very advantageous effects, and much improvement in the business of sheep-farming.

SORTINSKOL, in *Geography*, a town of Russia, in the government of Tobolsk; 72 miles S.S.W. of Berezov.

SORTOWITZ, a town of Prussia, in the palatinate of Culm; 10 miles N. of Culm.

SORVIODUNUM, or *SORBIODUNUM*, in *Ancient Geography*, a town of the isle of Albion, upon the route from Calleva to Vrioconium, in passing by Muridunum between Brige and Vindocladia, according to the Itinerary of Antonine; Calleva being Silchester, Muridunum, being Eggerton, Vrioconium being Wroxeter, Brige being Broughton, Vindo-

Vindocladia near Cranburn, and Sorbiodonum being Old Sarum.

SORUNDO, in *Geography*, a town of Sweden, in Sudermanland; 20 miles S.S.W. of Stockholm.

SORUS, in *Botany* and *Vegetable Physiology*, from *σρος*, a heap, is a term recently introduced, for the assemblage of capsules in Ferns, which had hitherto been called a dot, spot, or line, according to its particular figure. (See *FILICES*.) The *Sori* in many kinds of *Polypodium* and *Aspidium* are very much elevated, or prominent, well answering to this appellation, which is indeed, in every case, more correct and less exceptionable than the terms it supersedes. In an early state, the *Sori* are little more than spots, more or less opaque, or quite pellucid, in whose homogeneous substance nothing can be discerned of the mystery of impregnation, though certainly performed there. Whether that mystery takes place before the shape of each particular capsule is developed, we cannot determine, though it appears most probable; for if the *Sori* swell at all, they do not seem to fail afterwards. If they do not come to perfection, they remain in their original state, of a scarcely conspicuous dot.

SORUT, in *Geography*, a circar of Hindoostan, in Guzerat; 120 miles long, and 40 broad.

SORWY, a river of Monmouthshire, which runs into the Edwith.

SORY, in *Natural History*, the name of a fossile substance, much spoken of by the ancients, but erroneously supposed to be now lost.

It is a firm and not brittle substance, though of a spongy and cavernous structure, and is considerably heavy. It is found in masses of no regular shape or size, some being roundish, others angular or flatted, and some of the size of a walnut, others of many pounds weight. It feels very harsh and rough to the touch, and is covered with no investient coat or crust, but shews its natural surface, which is always corrugated or wrinkled, and usually full of small protuberances and cavities, and when broken, is found to be of a rugged and spongy structure within.

Its natural colour is a rusty black, but it is sometimes reddish, and sometimes blueish: and is commonly stained, in different places, with spots of a blueish or rust colour, when black; and of a greenish hue, when it is of a reddish colour: in the places where it is free from these, it is usually somewhat bright and sparkling. It is of an acrid and disagreeable taste, and of a strong and nauseous smell; put into the fire it burns to a deep purple; and if boiled in water a great part of it becomes dissolved in it; and this may again be separated from the water by evaporation and crystallization, and then appears in the form of pure blue vitriol, forming regular rhomboidal crystals, and tinging iron to a copper colour, on being first wetted, and then rubbed upon it.

It is found in many parts of the Turkish dominions, particularly in Gallo-Græcia; as also in some parts of Germany. In this country it is boiled for the blue vitriol it contains. In Turkey it is mixed with lime, and made into a paste with water, which is laid on such parts of the body as they would eradicate the hair from, and effects that purpose in a very few minutes. In the eastern nations, where it is thus used, it is known by the name of *rufma*.

The ancients used it externally to take off pimples, and put a piece of it into a hollow tooth, as a remedy for the tooth-ache. There can be no doubt of their sory being the same substance with this; since Dioscorides has described it to be blackish in colour, full of small cavities, moist on the

surface, (as ours always is in moist weather,) and of a disagreeable taste and smell.

This substance, as also the chalcitis, mify, and melanteria, are all properly ores of vitriol, the particles of those salts being so perfectly blended in them, as not to be at all distinguishable to the naked eye, yet being always regularly separable from them by water, which is to the saline ores what fire is to those of the metalline kind. Hill's Hist. of Foss. p. 606.

SORYGAZA, in *Ancient Geography*, a town of India, on the banks and on the other side of the Ganges, towards the eastern coast. Ptolemy.

SOS, in *Geography*, a town of France, in the department of the Lot and Garonne; 10 miles S.W. of Nerac.—Also, a town of Spain, in Aragon; 30 miles W. of Jaca.—Also, a river of Spain, in Aragon, which runs into the Sinca, near Monçon.

SOSA, a town of Saxony, in the circle of Erzgebirg; 22 miles S.S.W. of Chemnitz.

SOSE, a river of Germany, which runs into the Ruhme, 9 miles E. of Nordheim.

SOSES, a town of Spain, in Catalonia; 6 miles S.W. of Lerida.

SOSIBES, in *Ancient Geography*, a people who inhabited the environs of Asiatic Sarmatia, and who are comprehended, by Julius Capitolinus, in the number of those who had conspired against the Roman empire, under Marcus Antoninus the philosopher.

SOSIGENES, in *Biography*, a Peripatetic philosopher, and skilful astronomer, was brought from Egypt by Julius Cæsar, with the view expressly of assisting him in reforming the calendar. The philosopher, by tolerably accurate observations, discovered that the year was 365 days and 6 hours; and to make allowance for the odd hours, he invented the intercalation of one day in four years; and the duplication of the sixth day before the calends of March was the intercalary day: and hence the year in which this took place was called Bissextile. This was called the Julian year, the reckoning by which commenced in the 45th year B.C., and continued till it gave place to something more accurate, and a still farther reformation under pope Gregory XIII. Sosigenes was author of a commentary upon Aristotle's book "De Cælo."

SOSIPPUS PORTUS, in *Ancient Geography*, a port of Arabia Felix, on the coast of the Arabian gulf, between Musa Emporium and Pseudocelis, according to Ptolemy.

SOSNINSKAIA, in *Geography*, a town of Russia, in the province of Novgorod; 32 miles N. of Novgorod.

SOSNITZA, a town of Russia, in the government of Novgorod Sieverskoi; 32 miles S.S.W. of Novgorod Sieverskoi. N. lat. 51° 30'. E. long. 32° 46'.

SOSNOPA, a town of Russia, in the government of Perm; 48 miles S. of Ofa.

SOSNOVOI, an island of Russia, in the river Angara; 96 miles N.N.W. of Ilmsk.

SOSNOVSKOI, a town of Russia, in the government of Kolivan. N. lat. 55° 50'. E. long. 85° 44'.

SOSPELLO, a town of France, in the department of the Maritime Alps, and chief place of a canton, in the district of Monaco; divided by a small river into two parts. The town contains 2990, and the canton 5512 inhabitants, on a territory of 142½ kilometres, in 4 communes. It is the see of a bishop, united with Vintimiglia; containing four churches, one of which is a cathedral, and two convents; 10 miles N.E. of Nice.

SOSPIRO, Ital., *Soupir*, Fr., a crotchet rest in *Music*. See CHARACTERS and TIME-TABLE.

SOSPIRO, *Al Canone*. See *CANONE al Sospiro*.

SOSSINATI, in *Ancient Geography*, a name given to one of the four classes of mountaineers in the isle of Sardinia, who took up their abode in caverns. Strabo.

SOSSIUS, a river on the southern coast of Sicily, between the town Pintia and the mouth of the river Ibarus. Ptolemy.

SOSTENUTO, in *Italian Music*, *Soutenu*, Fr., sustained, continuing sounds and uniting them to each other, in opposition to *spiccato*, detached. See *LEGATO*.

SOSTI, in *Geography*, a town of Naples, in Calabria Ultra; 10 miles S. of Squillace.

SOSTRATUS, in *Biography*, the most eminent architect of his time, was a native of Gnidus, in Lesser Asia, and flourished in the third century before the Christian era. The patronage which he met with, caused him to be denominated the friend of kings; and he was particularly in favour with Ptolemy Philadelphus, sovereign of Egypt. He is celebrated in history likewise for the terraces, supported on arcades, which adorned his native city; and the famous *Pharos*, the light-house of Alexandria, which was reckoned one of the wonders of the world. He transmitted his name to posterity by an inscription on this light-house, in the Greek language, of which the translation is, "Sostratus of Gnidus, the son of Dexiphanes, dedicates this to the gods, the protectors of navigators."

SOSVA, in *Geography*, a river of Russia, which rises in the government of Tobolsk, N. lat. $61^{\circ} 10'$. E. long. $59^{\circ} 54'$, soon after enters into the province of Ekaterinburg, and takes a southern course to lat. 59° , then bends its course easterly, and loses itself in lake Phelim, in the government of Tobolsk, N. lat. $59^{\circ} 15'$. E. long. $63^{\circ} 54'$.—Also, a river of Russia, which runs into the Oby, 40 miles S. of Berezov.

SOSZNIZOWITZ, or *SASZINKOWITZ*, a town of Silesia, in the principality of Oppeln; 35 miles S.E. of Oppeln. N. lat. $50^{\circ} 14'$. E. long. $18^{\circ} 28'$.

SOTA DE PALANA, a town of the island of Cuba; 100 miles S.W. of Havana.

SOTCHEOU, a town of Corea; 403 miles E. of Peking. N. lat. $40^{\circ} 9'$. E. long. $124^{\circ} 34'$.

SOTELLO, a town of Spain, in Old Castile; 30 miles S. of Burgos.

SOTER, in *Biography*, pope, a native of Fondi, in the Campagna of Rome, was elected to the Roman see on the decease of Anicetus, in the year 168. During the period that he ruled the church, the heresy of the Montanists made its appearance, and he is said to have composed a book against their doctrines; but as the title is not known, the fact itself is liable to much doubt. Four decretals have been ascribed to him, but they are generally regarded as spurious. He died in 176, and he has been enrolled among the martyrs by modern writers, but no ancient one gives him that title. He is, however, generally commended for the contributions which he caused to be raised for the relief of the poor brethren in foreign countries, and particularly for those who were condemned to the mines, on account of their faith.

SOTERIA, formed from *σωτηρ*, *salvator*, in *Antiquity*, sacrifices offered to the gods, in gratitude for their having delivered a person from danger. See *SACRIFICE*.

The term is also applied to poetical pieces composed for the same end. Orpheus is the first who appears to have composed *soteria*.

Our Latin poets give the same name to poems in Latin verse, written to give thanks to God, or the saints, for having preserved them on any occasion. F. Petavius being

delivered from a dangerous disease, by the intercession, as he supposed, of St. Genevieve, composed that fine piece in honour of that saint, still extant under the title of "*Soteria*."

SOTERUS, in *Ancient Geography*, a port of the Arabian gulf, according to Diodorus Siculus.

SOTI, in *Geography*, a town of Africa, in the country of Whidah; 18 miles W. of Sabi.

SOTIRA, in *Ancient Geography*, a town of Asia, in Aria. Ptol.—Also, a town of Asia, in Cappadocia, Pliny.—Also, a town of Parthia. Arrian.

SOTIRELLA, a name given by some to a compound medicine, in form of a hard mass, and consisting of opium, and some other narcotics, with camphor, wood-foot, and nutmeg. It is described in the Augustan Dispensatory, and is intended to be put into hollow teeth, as a remedy for the tooth-ache.

SOTO, DOMINIC, in *Biography*, a learned Spanish ecclesiastic, was born at Segovia in 1494. His father was a gardener, and his circumstances being of a very humble nature, he destined his son for the same occupation; but having learned the elements of instruction, he officiated in the duties of sacristan in a village church, and at length rendered himself qualified to study philosophy at the university of Alcalá. He afterwards completed his studies at Paris; and on returning to Spain, entered into the Dominican order. He was employed as a professor in different universities, and published commentaries on the Aristotelian philosophy. In 1545 he was deputed as a theologian to the council of Trent, and was one of the persons to whom was committed the office of recording decisions of the assembly, and drawing up its decrees. He was a frequent and able speaker in the council, and maintained the proposition, "that the residence of bishops is of divine right." The emperor Charles V., in 1549, offered him the bishopric of Segovia, which he refused. He was, however, persuaded to take the office of judging between Las Casas and Sepulveda, in their contest respecting the Indians, which he determined in favour of the former. He then retired to Salamanca, where he died in 1560. His chief works are, "*De Justicia et Jure*;" "*De Tegendis Secretis*;" "*De Pauperum Causa*;" "*De Cavendo Juramentorum Abusu*."

SOTOVENTO, in *Geography, a name applied to the Lesser Antilles in the West Indies. Among these, the chief may be reckoned Trinidad, Margaretta, Curassoa, and Tortugas.*

SOTOVENTO Lobos, or *Leeward Island of Sea-Wolves or Seals*, an island on the coast of Peru; 7 leagues from Barvento Lobos, or Windward island of sea-wolves. It is about 6 miles in circuit, and 15 miles from Cape Aguja.

SOTTEGHEM, a town of France, in the department of the Scheldt, and chief place of a canton, in the district of Audenaerde. The place contains 1508, and the canton 14,603 inhabitants, on a territory of $77\frac{1}{2}$ kilometres, in 14 communes.

SOTTERN, a lake of Sweden, in the province of Nericia; 14 miles S.E. of Orebro.

SOTTEVAST, a town of France, in the department of the Channel; 9 miles W. of Valognes.

SOTTEVILLE, a town of France, on the south side of the Seine; 3 miles S. of Rouen.

SOTTO VOCE, in *Italian Music*, implies a degree of piano, or soft, and subdued voice; which is sometimes expressed by *mezzo forte*, and *mezza voce*, half piano.

SOU, in *Commerce*. See *Sol*.

SOV, or *So-tcheou*, in *Geography*, a town of China, of

the second rank, in Chen-fi. N. lat. 39° 38'. E. long. 98° 44'.

SOUADI, or SOUALLY, a town of Egypt, on the east side of the Nile; 23 miles S. of Abu Girgê. This burgh is governed by a cachef; and west of it are two Coptic monasteries, situated at the entrance of the desert. Their churches are ornamented with Corinthian pillars, with a cross in the middle of the capital; and they are paved with red granite, covered with hieroglyphics. Their architecture is said by Savary to indicate the decline of taste among the Greeks. They are thought to have been built by the empress Helena. On the space between them are strewed antique marbles. These remains point out the site of Crocodilopolis, or the sacred city of this name, which was far from the river, and which Ptolemy places after Aphroditopolis, or the city of Venus.

SOUADY, or SOHAR, a small island in the Arabian sea, near the coast of Oman. N. lat. 24° 14'.

SOVANA, a town of Etruria, the see of a bishop; 45 miles N.N.W. of Rome.

SOUANANPOUR, a town of Hindoostan, in Golconda; 10 miles S. of Hydrabad.

SOVANOCALCHI, in *Ancient Geography*, a people of Asiatic Sarmatia, upon the banks of the Euxine sea. Ptolemy.

SOUBES, in *Geography*, a town of France, in the department of the Herault; 3 miles N. of Lodeve.

SOUBIZE, a town of France, in the department of the Lower Charente; 3 miles W. of Rochefort.

SOUC, a town of Thibet; 360 miles N.N.E. of Lassa. N. lat. 33° 18'. E. long. 94° 24'.

SOUCTOU, a mountain of Thibet. N. lat. 32° 18'. E. long. 84° 19'.

SOUCY, a town of France, in the department of the Yonne; 19 miles S. of Provins.

SOUDAH, a rocky desert country of Africa, between Tripoli and Fezzan.

SOUDAN, from *Souda* or *Suda*, which signifies in Arabic *black*, a name given by the Moors and Arabs to Negroland, or Nigritia; and sometimes more particularly to the empire of Haussa, or Houssa. Abulfeda includes the whole lower part of Africa, south of the Great Desert and Egypt, under the denomination of Belad Soudan, or the country of Soudan. With him Soudan is the southern quarter of the globe; and d'Herbelot also allows it a wide range. See NEGROLAND.

SOUDE ST. CROIX, a town of France, in the department of the Marne; 10 miles W. of Vitry.

SOVEIB, a town of the Arabian Irak, on the Euphrates; 20 miles N.W. of Bassora.

SOUE-KI, a town of China, of the third rank, in Quang-tong; 30 miles S.W. of Hoa.

SOVEL, a small island in the Chinese sea, near the coast of Tonquin. N. lat. 11° 2'. E. long. 105° 25'.

SOUE-OUIE-CHAN, a town of Corea; 30 miles N.W. of Long-kouan.

SOVERDEM, a town of Italy; 3 miles N. of Belluno.

SOVEREIGN, SUPREME, the chief and highest Being, or the Almighty; a term, in strictness, only applicable to God.

The word is French, *soverein*; which Pasquier derives farther from the Latin *superior*, the first in any thing; or he who is superior to the rest. Hence,

In the ancient French customs we meet with sovereign master of the household; sovereign master of the forests; sovereign master of the treasury. Under Charles VI. the

title sovereign was given to bailiffs and seneschals, with regard to their superiority over prevots, and chatelains.

SOVEREIGN, with regard to subjects, is applied to kings and princes, who are supreme and independent.

The authority of a sovereign is only bounded by the law of God, of nature, and the fundamental laws of the state. See KING. See SOVEREIGNTY, *infra*.

SOVEREIGN is also a title given to such as are invested with certain rights and prerogatives, which belong only to sovereigns; as the power of coining money, sending agents to diets, to treat of war and peace, &c.

In which sense the feudatories of the empire, and the tributaries of the grand signior, are called sovereigns.

SOVEREIGN is also applied to courts and judges, who have a power from a prince to decide the processes of his subjects without appeal, or in the last resort.

At Paris, under the old regime, there were five sovereign companies: the parliament, the chamber of accounts, the court of aids, the grand council, and the court of monies.

In England we have but one sovereign court, which is the house of lords.

SOVEREIGN, in *English Coinage*, a gold coin of 20s. value, equal to the double ryal, which was coined by order of Henry VII. in the year 1485; and this was accompanied by the double sovereign of 40s. Henry VIII., in 1527, added to the gold denominations sovereigns of 22s. 6d., and ryals of 11s. 3d., angels of 7s. 6d., and nobles at their old value of 6s. 8d. In 1546 the same prince, after raising the value of silver, and making it to gold as 1 to 5, struck sovereigns of the former value of 20s., and half-sovereigns in proportion. Upon the union of the crowns, James I. of England gave the sovereign the name of unite, it being then of 20s. value. The sovereign, which had been commonly termed the "broad-piece," under the Commonwealth assumed the univindious name of the twenty-shilling piece, which it retained till supplanted by that of the guinea, which was proclaimed in 1663, and to pass for 20s. But it never went for less than 21s. by tacit and universal consent. Pinkerton's *Ess. on Medals*, vol. ii.

SOVEREIGNTY, in *Political Economy*, denotes that public authority, which commands in civil society, ordering and directing what each is to perform, in order to obtain the end of its institution. This authority belonged originally and essentially to the body of the society, to which each member submitted, and ceded the rights he received from nature, to conduct himself in every thing as he pleased, according to the dictates of his own understanding, and to do himself justice. But the body of this society does not always retain this sovereign authority: it frequently trusts it to a senate, or to a single person. This senate, or this person, is then the sovereign. (See SOVEREIGN, *supra*.) It is evident that men form a political society, and submit to laws, solely for their own safety and advantage. The sovereign authority is then established, only for the common good of all the citizens; and it would be absurd to think that it could change its nature, on its passing into the hands of a senate, or a monarch. Flattery, therefore, cannot disown, without rendering itself equally ridiculous and odious, that the sovereign is only established for the safety of the state, and the advantage of society.

A good prince, a wise conductor of society, ought to have his mind impressed with this great truth, that the sovereign power is only entrusted with him for the safety of the state, and for the happiness of all his people; that he is not permitted to seek himself in the administration of affairs, to propose his own satisfaction, or his private advantage; but that he ought to direct all his views, all his steps, to

SOVEREIGNTY.

the great advantage of the state and people who have submitted to him. How noble a sight is it, says the admirable Vattel, to see a king of England acquaint his parliament with all his principal operations; assure that body, the representatives of the nation, that he proposes no other end but the glory of the state, and the happiness of his people; and affectionately thank all who concur with him in such salutary views! Certainly a monarch, who makes use of this language, and proves his sincerity by his conduct, is, in the opinion of the wise, the only great man. But for a long time a base flattery has, in most kingdoms, caused these maxims to be forgotten. A crowd of fervent courtiers without difficulty persuade a proud monarch, that the nation was made for him, and not he for the nation. He soon considers the kingdom as his patrimony, and his people as a herd of cattle, from which he may obtain riches, and dispose of them so as best to answer his views, and gratify his passions. From thence arise those fatal wars, undertaken by ambition, selfishness, hatred, and pride: from thence those oppressive taxes, dissipated by luxury, or squandered upon mistresses and favourites: from thence, in fine, are important posts given by favour, while public merit is neglected, and every thing that does not immediately interest the prince, abandoned to ministers and subalterns. Who can observe, in this unhappy government, authority established for the public welfare? A great prince will be on his guard, even against his virtues. Let us not say, with some writers, that private virtues are not the virtues of kings; the maxim of superficial politicians, or of those who are very inaccurate in their expressions. Goodness, friendship, gratitude, are still virtues of the throne; and would to God they were to be always so! But a wise king does not, without discernment, give himself up to their impressions. He cherishes them, he cultivates them in his private life; but in state-affairs he listens only to justice and sound politics. And why? because he knows that the government was trusted to him only for the happiness of society; and that, therefore, he ought not to consult his own pleasure in the use he makes of his power. He tempers his goodness with wisdom. He gives to friendship his domestic and private favours; he distributes posts and employments according to merit; public rewards to services done to the state. In a word, he uses the public power only with a view to the public welfare. All this is comprehended in the fine saying of Lewis XII., "A king of France does not revenge the injuries of a duke of Orleans."

A political society is a moral person, as it has an understanding and a will, of which it makes use for the conduct of its affairs, and is capable of obligations and laws. When, therefore, a people confer the sovereignty on any one person, they invest him with their understanding and will; and make over to him their obligations and rights, so far as relates to the administration of the affairs of state, and the exercise of the public authority; thus the sovereign, or conductor of the state, becoming the subject, in which reside the obligations and rights relative to government, in him is found the moral person, who, without absolutely ceasing to exist in the nation, acts from thence forwards only in and by him. Such is the origin of the representative character attributed to the sovereign: He represents the nation in all the affairs it was capable of managing as sovereign. It does not debase the dignity of the greatest monarch to attribute to him this representative character; on the contrary, nothing can make him shine with greater lustre: for by this means the monarch unites, in his own person, all the majesty that belongs to the entire body of the nation.

The sovereign, thus clothed with the public authority, with every thing that constitutes the moral personality of the nation, is under the obligations of that nation, and invested with its rights.

Every thing that concerns the general duties of a nation towards itself, particularly regards the sovereign. He is the depositary of the empire, and of the power of commanding whatever relates to the public welfare: he ought, therefore, as a tender and wise father, and as a faithful administrator, to watch for the nation, to take care of preserving it, to render it more perfect, to better its state, and to secure it, as much as he is able, from every thing that threatens its safety, or its happiness.

The prince derives his authority from the nation; and it is exactly equal to what they have entrusted him with. If the nation has simply and strictly invested him with the sovereignty without limitation, or division, he is supposed to be invested with all the prerogatives, without which the sovereign command, or authority, could not be exerted in the manner most conducive to the public welfare. These are called *regal prerogatives*, or *the prerogatives of majesty*.

But the sovereign power is limited and regulated by the fundamental laws of the state: those laws shew the prince the extent and bounds of his power, and the manner in which it ought to be exerted. The prince is, therefore, strictly obliged not only to respect, but also to support them. The constitution and the fundamental laws are the plan on which the nation has resolved to endeavour the obtaining of happiness: the execution is entrusted to the prince. If he religiously follows this plan; if he regards the fundamental laws as inviolable and sacred rules, and knows that the moment he deviates from them, his commands become unjust, and are no less than a criminal abuse of the power with which he is entrusted. He is, in virtue of this power, the guardian and defender of the laws; and being obliged to punish any one who shall presume to violate them, he himself ought not to trample them under his feet.

While the laws of a society, over which a sovereign presides, subsist, he ought religiously to maintain and observe them. This is no less his true interest than his duty. But in explaining this submission of the prince to the laws, Vattel observes, that he is above all civil penal laws. The majesty of a sovereign will not suffer his being punished like a private person; and his employments are too sublime to admit of his being troubled, under the pretence of a fault that does not directly concern the government of the state. His person, therefore, should be regarded as inviolable. Nevertheless, this high attribute of sovereignty is no reason why a nation should not curb an insupportable tyrant, call him even to an account, respecting in his person the majesty of his rank, and withdraw itself from his obedience. To this indisputable right a powerful republic owes its birth. The tyranny exercised by Philip II. in the Netherlands, excited those provinces to rise: seven of them, closely confederated, bravely maintained their liberties, under the conduct of a hero of the house of Orange; and Spain, after several vain and destructive efforts, acknowledged them sovereign and independent states. If the authority of the prince is limited and regulated by the fundamental laws, the prince, on leaving the bounds prescribed him, commands without any right, and even without a just title: the nation, then, is not obliged to obey him, but may resist his unjust enterprizes. As soon as he attacks the constitution of the state, the prince breaks the contract which bound the people to him; the people became free by the act of the sovereign, and see nothing in him but an usurper who would load them with oppression. This truth is acknowledged by every sensible

writer, whose pen is not enslaved by fear, or rendered venal by interest. But some celebrated authors maintain, that if the prince is invested with the supreme command in a full and absolute manner, nobody has a right to resist him, much less to curb him, and that the nation has no resource left but to suffer and obey with patience. This is founded upon the supposition that such a sovereign need not give an account to any person of the manner in which he governs; and that if the nation might controul his actions and resist him, where they were found to be unjust, his authority would no longer be absolute; which would be contrary to this hypothesis. They say, that an absolute sovereign possesses completely all the political authority of the society, in which nobody can oppose him; if he abuses it, he does ill, indeed, and wounds his conscience, but that his commands are not the less obligatory, as being founded on a lawful right to command: that the nation, by giving him absolute authority, had reserved nothing to itself, and had submitted to his discretion, &c. We might satisfy ourselves with answering, that in this light there is not any sovereign who is completely and fully absolute. But in order to remove all these vain subtilties, let us remember the essential end of civil society: is it not to labour in concert for the common happiness of all? Is it not with this view that every citizen strips himself of his rights, and resigns his liberty? Was it in the power of the society to make such use of its authority as to deliver up itself, and all its members, without relief, to the discretion of a cruel tyrant? No, certainly, since it had no right itself, if it was disposed to it, to oppress a part of the citizens. When it, therefore, conferred the supreme and absolute government, without an express reserve, it was necessarily with the tacit reserve, that the sovereign should use it for the safety of the people, and not for their ruin. If he becomes the scourge of the state, he degrades himself; he is no more than a public enemy, against whom the nation may and ought to defend itself; and if he has carried his tyranny to the utmost height, why should even the life of so cruel and perfidious an enemy be spared? Who presumes to blame the Roman senate, that declared Nero an enemy to his country?

But it is of the utmost importance to observe, that this judgment can only be passed by the nation, or by the body by which it is represented; and that the nation itself cannot make any attempt on the person of the sovereign, but in cases of extreme necessity, and when the prince, by violating the laws, and threatening the safety of his people, puts them in a state of war against them. The person of the sovereign, the very interest of the nation declares sacred and inviolable; but not that of an unnatural tyrant, and an enemy of the public. We seldom see such monsters as Nero.

As soon as a nation acknowledges a prince for its lawful sovereign, all the citizens owe him a faithful obedience. He can neither govern the state, nor perform what the nation expects from him, if he is not punctually obeyed. Subjects then have no right, in doubtful cases, to question the wisdom or justice of their sovereign's commands; this examination belongs to the prince: his subjects ought to suppose, if there be a possibility of doing it, that all his orders are just and salutary: he alone is accountable for the evil that may result from them.

In the mean time, this ought not to be entirely a blind obedience. No engagement can oblige, or even authorize, a man to violate the laws of nature. All authors who have any regard to conscience, or modesty, agree, that a person ought not to obey such commands as are evidently contrary to the laws of God. Those governors of places,

who bravely refused to execute the barbarous orders of Charles IX. to the famous St. Bartholomew, have been universally praised; and the court did not dare to punish them, at least openly. "Sire," said the brave Orte, governor of Bayonne, in his letter, "I have communicated your majesty's command to your faithful inhabitants and warriors in the garrison; and I have found there only good citizens and brave soldiers: not one hangman; therefore, both they and I most humbly entreat your majesty, to be pleased to employ our arms and lives in things that are possible, however hazardous they may be, and we will exert ourselves to the last drop of our blood." The count de Tende, Charney, and others, replied to those who brought them the orders of the court, that they had too great a respect for the king, to believe that such barbarous orders came from him.

It is not easy to determine in what cases a subject may not only refuse to obey, but even resist a sovereign, and by force repel force. However, when the injuries, which society suffers, are manifest and atrocious; when a prince, without any apparent reason, is resolved to deprive us of life, or of those things, the loss of which would render life bitter, who can dispute our right to resist him? Self-preservation is not only a law of nature, but an obligation imposed by nature, and no man can entirely and absolutely give it up to another. And though he might give it up, can he be considered as having done it by his political engagements, when he entered into society only to establish his own safety upon a more solid basis? The welfare of society does not require such a sacrifice; and as Barbeyrac well observes in his notes on Grotius, "If the public interest requires, that those who obey should particularly suffer something; it is not less for the public interest that those who command, should be afraid of carrying their patience to the utmost extremity." The prince who violates all laws, who observes no measures, and who would in his transports of fury take away the life of an innocent person, strips himself of his royalty, and is no more than an unjust and outrageous mortal, against whom his people are allowed to defend themselves. But he who, after having lost all the sentiments of a sovereign, divests himself even of the appearances and exterior conduct of a monarch, degrades himself; he no longer retains the sacred person of a sovereign, and cannot retain the prerogatives attached to his sublime character. However, if this prince is not a monster, if he is furious only from a just passion, and is supportable to the rest of the nation; the respect we ought to pay to the tranquillity of the state is such, and the respect of sovereign majesty so powerful, that we are strictly obliged to seek every other means of preservation, rather than to put his person in danger. Every one knows the example set by David: he fled; he kept himself concealed, to secure himself from Saul's fury; and more than once saved the life of his persecutor. When the reason of Charles VI. of France was suddenly disordered by a fatal accident, he in his fury killed several of those who surrounded him: none of them thought of securing his own life, at the expence of that of the king; they only endeavoured to disarm him, and to make him master of himself: they did their duty like brave men and faithful subjects, in exposing their lives, to save that of this unfortunate monarch. We owe this sacrifice to the state and to sovereign majesty. Furious from the disorder of his organs, Charles was not guilty; he might recover his health, and again become a good king.

We shall here further observe, that a sovereign is undoubtedly allowed to take ministers, to ease him in the painful office of government; but he ought never to abandon

don his authority to them. Ministers ought only to be instruments in the hands of the prince; he ought constantly to direct them, and continually endeavour to know whether they follow his instructions. Ministers, however, who undertake this charge, become responsible to the state for their conduct; for the advice which they are supposed to give to the sovereign, and for the measures which they adopt and pursue. Vattel's Law of Nations, b. i. ch. 4.

SOVERICK, in *Geography*, formerly known by the name of *Sauro*, a town of the pachalic of Orfa, a pachalic which is almost entirely encircled by the windings of the Euphrates and the river Khabour, and occupying a considerable portion of the most barren part of Mesopotamia. The town is situated, according to Niebuhr, in N. lat. $37^{\circ} 48'$, and contains about 500 inhabitants, with three mosques, and a strong castle. The country to the south of the parallel of Soverick is, for the most part, flat, sandy, and uncultivated, and inhabited by tribes of wandering Arabs, who pitch their tents on the banks of the rivers, and in the vicinity of springs. From Soverick to Diarbekir it is more mountainous, and better inhabited.

SOUF, or VOSTANI, the middle district of Egypt, between the Bahira and Said.

SOUFFEL, a river of France, which runs into the Rhine, four miles below Strasburg.

SOUFFLEUR, Fr., the bellows-blower of an organ.

SOUFFLOT, JAMES-GERMAIN, in *Biography*, an eminent architect, was born in 1714 at Irancy, near Auxerre. His father, an advocate in parliament, destined him for his own profession, and sent him, while very young, to Paris for education; but he felt a taste and inclination for the science of architecture. Having been employed for some time in that art at Lyons, he went into Italy, where, by his talents and industry, he was admitted one of the king's pensioners. It being resolved that several public buildings should be erected at Lyons, he was recommended to undertake a part of the work, by the director of the French academy at Rome; and the construction of the exchange and the hospital was committed to him. The noble simplicity of the hospital, together with its excellent adaptation to the object for which it was intended, were universally admired, and raised him to high reputation as an artist. He was, after this, employed to build the concert-room and theatre of the same city. He next travelled into Italy, and on his return he settled at Paris, where he was successively made controller of the buildings at Marly and the Tuilleries, member of the academies of architecture and painting, knight of St. Michael, and intendant of the royal buildings. In 1757 he laid the foundation of the church of St. Genevieve, of which he was able only to finish the portal, the nave, and the towers. In this business he subjected himself to some severe criticism, especially with respect to the possibility of erecting the intended dome upon the bases designed to bear it; though some exact calculations justified his plan. The criticisms and unfriendly remarks of his rivals were more than his temper, naturally irritable, could bear; and he died, partly of chagrin, in the year 1780, at the age of 67. Besides the public works already mentioned, he executed many others, which display the powers of a great artist; and after his death, M. Dumont, professor of architecture, published a book of Designs, which he had left behind him, under the title of "Elevations et Coupes de quelques Edifices de France et d'Italie, dessinées par feu M. Soufflot, Architecte du Roi, et gravées par ses Ordres." Though Soufflot was rough and hasty in his manners, he was kind and friendly; whence he obtained the name of *le Bourru Bienfaisant*.

SOUFFRIERE BAY, in *Geography*, a bay on the east coast of the island of Dominica. N. lat. $15^{\circ} 31'$. W. long. $61^{\circ} 17'$.

SOU-FONG, a town of China, of the third rank, in Kiang-nan; 47 miles S.W. of Ngan-king.

SOUGH, in *Agriculture*, a covered drain of any size, but commonly of the more large kind. Sough drains are most commonly employed in the business of spring-draining, though occasionally in other modes. See *SPRING-Drain* and *SPRING-Draining*.

SOUGH, otherwise called an *Adit*, in *Mineralogy*, is a passage like a vault cut out under the earth, to drain the water from the mines.

In a canal, it denotes a small culvert or leading.

SOUHAITOU, in *Geography*, a town of Thibet; 28 miles W.N.W. of Yolotou Hotun.

SOUI, a city of China, of the second rank, in Hou-quang; 527 miles S. of Peking. N. lat. $31^{\circ} 48'$. E. long. $112^{\circ} 40'$.

SOU-CHONTO, a town of Chinese Tartary, in the country of Hami. N. lat. $41^{\circ} 8'$. E. long. $94^{\circ} 37'$.

SOVIESE, a town of European Turkey, in Moldavia; 44 miles W. of Birlat.

SOU-KI, a town of China, of the third rank, in Quang-tong; 30 miles N. of Louy.

SOULLAC, a town of France, in the department of the Lot, and chief place of a canton, in the district of Gourdon. The place contains 1654, and the canton 8158 inhabitants, on a territory of $182\frac{1}{2}$ kilometres, in 10 communes.

SOUILLY, a town of France, in the department of the Meuse, and chief place of a canton, in the district of Verdun. The place contains 792, and the canton 7528 inhabitants, on a territory of 230 kilometres, in 21 communes.

SOUIN-HING, a town of China, of the third rank, in Hou-quang; 20 miles E.S.E. of Tsin.

SOU-PIING, a town of China, of the third rank, in Ho-nan; 17 miles W.N.W. of Yun-hing.

SOU-TCHEOU, a city of China, of the first rank, in Se-tchuen, at the conflux of the rivers Yan and Kincha; 850 miles S.W. of Peking. N. lat. $28^{\circ} 40'$. E. long. $104^{\circ} 23'$.

SOU-TE, a city of China, of the second rank, in the province of Chen-si, on the Voutin river; 337 miles W.S.W. of Peking. N. lat. $37^{\circ} 38'$. E. long. $109^{\circ} 34'$.

SOU-YANG, a town of China, of the third rank, in Se-tchuen; 20 miles N.N.E. of Tfun-y.

SOUKAPURA, a kingdom on the south coast of the island of Java.

SOUKENE, a town of Africa; 130 miles S. of Tripoli.

SOUKERKE, a town of France, in the department of the Lys; 5 miles N.W. of Bruges.

SOUKETON, a river of New Hampshire, which runs into the Merrimack, N. lat. $42^{\circ} 48'$. W. long. $71^{\circ} 30'$.

SOU-KISE, a town of China, in Hou-quang, on the river Lo; 55 miles N.N.W. of Pao-king.

SOUL, ANIMA, a spirit adapted to an organized body. See *SPIRIT* and *BODY*.

Many of the ancient philosophers asserted an *ANIMA Mundi* (which see), a soul which moved and animated the machine of the universe, and gave action to all natural causes. This doctrine Plato handles very fully in his *Timæus*. (See *PLATONISM*.) For the doctrine of the Stoics on this subject, see *STOICS*. See also *PHERECYDES*.

The ancient Indians, who possibly derived their notions of

of God and providence from the Persian Zoroaster, conceived God to be the soul of the world, a rational and intellectual light, from which all good is derived, and the chief feat of whose divinity is the sun. Their notion of divine providence, deduced from that of the soul of the world, probably extended no farther than that this principle is necessarily the first spring of all motion, life, and enjoyment; and fell far short of that wise and gracious voluntary superintendance, which is the Christian idea of Providence.

Others have given particular souls to all the heavenly bodies, the sun, stars, earth, &c. to regulate their motions. The philosophers, many of them, allow of two, and others of three, kinds of souls; *viz.* a

SOUL, Rational, which they hold to be divine, and infused by the breath of God. This they call the spirit, and in this they suppose the intellect and will to be seated.

SOUL, Sensitive, or Irrational, which man has in common with brutes; which is formed out of the elements, and in which they apprehend the passions and appetites are seated.

SOUL, Vegetative, which we have in common with plants; and, as the first is the principle of reason and understanding, or that in us which thinks and understands; and the second, the principle of life; this is the principle of growth, nutrition, and vegetation.

The first ancient philosopher who taught the immortality of the soul, is said to have been Pherecydes. (See his article.) The human mind, according to the doctrine of the ancient Indians (see BRACHMANS), is of celestial origin, and has a near relation to God. When it departs from the body, it returns to its parent, who expects to receive back the souls which he has sent forth. The human soul they represented as of divine original, because, with all the other eastern nations, they conceived it to be a particle, or an emanation, of that intellectual fire, by which they believed the universe to be animated. Their doctrine of the return of the soul to God, which some have confounded with the Christian doctrine of the resurrection, seems to have meant nothing more than that the soul, after being disengaged from the grosser material body, would be reunited to the fountain of all being, the soul of the world. For the opinion of the Egyptians concerning the human soul, we refer to the article EGYPT.

Among the northern nations it was a generally received opinion, that the human soul was of divine original, rational and immortal. That this was the universal doctrine of the Celts, whether Gauls, Britons, Germans, or other nations, is unanimously attested by the Greek and Roman writers, and by the remains of northern antiquities. Cæsar informs us (Bell. Gall. lib. vi. c. 14.), that the first doctrine of the Gallic Druids was, that the soul of man is immortal; and Pomponius Mela (lib. iii. c. 2.) says, that one of their doctrines, which was divulged among the people in order to inspire them with martial courage, was, that the soul is immortal. This account is confirmed by Valerius Maximus (l. ii. c. 6.), Strabo (l. iv.), and other historians. And the fables every where received among the Celts concerning a future state, leave no room to doubt, that the doctrine of the immortality of the soul was generally received among them.

“ Without or breath, or reasoning pow’rs, or speech,
Or vital blood, or the fair human face,
Askus and Emla lay: till Odin bade
Them live, Hænerus kindled in their breast
The lamp of mind, and Lædur through their veins
Pour’d forth the purple stream; thus man arose,
Graceful in youth, an animated form.”

The history of all the northern nations abounds with facts, which prove that their contempt of death originated from an expectation of immortality. It does not, however, certainly appear, what kind of immortality these nations expected. According to Cæsar (l. ii. c. 6.) and Diodorus Siculus (l. i.), they thought, that the soul at death passes from one body to another. This doctrine of transmigration is also ascribed to them by Lucan (Pharf. l. i. v. 454.)

“ If dying mortals doom they sing aright,
No ghosts descend to dwell in dreadful night;
No parting souls to grisly Pluto go,
Nor seek the dreary silent shades below:
But forth they fly, immortal in their kind,
And other bodies in new worlds they find:
Thus life for ever runs its endless race,
And, like a line, death but divides the space.” Rowe.

On the contrary, Pomponius Mela represents the Celts as expecting to pass, after death, into the invisible world. And this notion best agrees with the accounts, which are given by various writers, of the funeral ceremonies practised in the northern nations, particularly that of committing to the funeral pile, or to the sepulchre, whatever had been dear to the deceased. It is also most consonant to the language of the ancient Edda, which every where represents the future life, as an assembly of good or bad men, in a state of reward or punishment, and only speaks of a return to life for the purpose of reuniting the soul and body, after the soul has passed through a necessary course of purification, previously to its admission into the regions of the happy. From this state of purgation none were to be excused, except those who had voluntarily exposed themselves to death in battle: and hence it was, that they who fell in war were deemed to have made a glorious and happy exit from life, whilst they who died by sickness were thought to have perished shamefully and wretchedly. See CELTS and DRUIDS.

Of the opinion of Socrates concerning the human soul, we have already given an account under the article SOCRATES. For Plato’s opinion, see PLATONISM. For an account of the Aristotelian doctrine on this subject, see ARISTOTLE. Strabo taught that the seat of the soul is in the middle of the brain; and that it only acts by means of the senses. (See STRABO.) Dicaearchus, of whom Cicero speaks as a learned and eloquent writer, maintained, that there is no such thing as mind, or soul, either in man or beast; that the principle, by which animals perceive and act, is equally diffused through the body, is inseparable from it, and expires with it. For the opinion of the Stoics, see STOICS. For the opinion of Pythagoras and his followers, see PYTHAGOREANS. See also EMPEDOCLES, DEMOCRITUS, and HERACLITISM.

The Epicureans took the substance of the soul, we mean of the rational soul, to be a subtle air, composed of their atoms, or primitive corpuscles. See EPICUREANS.

The tenets of the modern Platonists with regard to the soul of man, may be found in the writings of Plotinus, Jamblichus, and Porphyry, who may be reckoned among the principal persons that belonged to the Eclectic sect. Plotinus taught, that the first principle of the universe, which is distinct from the universe, is the cause of intellectual life and the source of essence and being, simple in its own nature, and having no place, and destitute both of motion and rest; infinite and unlimited, essentially good, and fair and beautiful, the author of all that is lovely, the beginning and end of beauty. From this first principle proceeds

proceeds mind, or intellect, and soul, or the active principle. The primary essential good is the centre; mind, the light emerging from it, and remaining fixed; soul, the motion of the emerging light; and body, the opaque substance, which is illumined by the soul. From the emanative energy of mind is produced soul, or the active principle of life. This divine principle is the fountain, whence all life is derived. It subsists, as well as intellect, within the divine essence, and is therefore *ὑπερέσμιον*, supramundane. This is the immediate source of the principle which animates the world, *ἐγκόσμιον*, and which is diffused, in various portions, through animated nature. The souls of men and inferior animals constitute the common limit between the intellectual and sensible world. The human soul is derived from the supramundane soul, or first principle of life, and is in this respect sister to the soul of the world. Souls are not in the body as their place, nor as their receptacle, nor as their subject, nor as a part of a whole, nor as form united to matter, but simply as the animating principle; and it is in this respect only, that we know the soul to be present with the body. The power of the soul is diffused through every part of the body; and though it be said to reside in its chief instrument the brain, it is incorporeal, and exists entirely every where within the sphere of its energy. Partaking of the nature of real being, it is immutable. It is the principle of motion, moving itself, and communicating motion to bodies. The vices and infelicities of the soul, are wholly derived from its union with the body.

Souls, in the periodical revolutions of nature, separate themselves from their fountain, and descend into the lower regions of the world. In their passage, they attract to themselves an ethereal vehicle, and at last sink into animal bodies, as into a cavern or sepulchre. But when, by the power of reminiscence, they again turn themselves to the contemplation of intelligible and divine natures, they regain their freedom. God, on account of his greatness, is not known by intelligence or sense, but by a kind of intuition superior to science, by means of which the soul can see him in his real nature, as the fountain of life, mind, and being, and the cause of good. A soul which has attained to this vision of God will lament its union with the body, and will rejoice to leave its prison, and return to the divine nature from which it proceeded. After death, the souls of men pass into other animals, or ascend into superior regions, and are converted into beings of an higher order, according to their present degree of defilement or of purification.

The human soul, according to Jamblichus, has an innate knowledge of God, prior to all reasoning, having originally derived its essence from, and subsisted in, the divine nature. By the intervention of *dæmons*, it enjoys communications with the superior divinities, and with God himself. Prayers, hymns, lustrations, and sacrifices are the means by which this intercourse is maintained. The mind of man, as we learn from the writings of Porphyry and others, originally a portion of the divine nature, having fallen into a state of darkness and defilement by its union with the body, is to be gradually emancipated from the chain of matter, and by contemplating real entities, to rise to the knowledge and vision of God. The end of philosophy is, therefore, the liberation of the soul from its corporeal imprisonment. For this purpose it must pass through the several stages of the human and divine virtues. The human virtues are physical, economical, and political; or those which respect the care of the body, and the offices of domestic and civil life. The divine virtues are purgative, theoretic, and therapeutic: the first class consists in bodily abstinence, and other

voluntary mortifications; the second comprehends all those exercises of the intellect and imagination, by which the mind contemplates abstract truth, and intelligible natures; the third includes those religious exercises, by which the philosopher is qualified for, and admitted to, an immediate intercourse with superior beings, attains a power over *dæmons*, and ascends so far above the ordinary condition of humanity, as to enjoy the vision of God in this life, and to return, at death, to the divine mind, whence it first proceeded. Thus, we have given a specimen of the visionary subtleties of the Alexandrian philosophy, or that of the Eclectic sect.

According to the popular doctrine of the Jews, in and after the tenth century, the soul of man is a thinking substance, having three faculties, the vegetative, the sensitive, and the rational: it is possessed of liberty, and is immortal. After death it is not immediately admitted to celestial joys, but wanders in this world, chiefly about its body, during which time it is tormented by evil *dæmons*; in this purgatory it is cleansed from its stains; after which it passes into either bodies of men, or inferior animals. There will be a resurrection of the bodies of dead men, and an universal judgment, which will be succeeded by a state of retribution. The soul will enjoy eternal life in paradise, and the wicked will be consigned to the infernal regions; the Jew for a time, but the infidel for ever. The world will be destroyed; but the materials of which it is composed will remain. Thus the modern Jews blended tenets, which they derived from their sacred scriptures, with opinions which they borrowed from their Gentile neighbours. They first suffered their doctrines to be corrupted by the Egyptian philosophy, and afterwards learned from the Saracens to reason, after the Peripatetic manner, upon metaphysical subjects; of which examples may be seen in the writings of Maimonides, and in the book *Cofri*. The human soul, according to the Cabbalistic doctrine, proceeding by emanation from the Deity, is an incorporeal substance, of the same nature with the divine intellect. Being united to the body, one complex nature is produced, endued with reason, and capable of action. The human soul consists of four parts, "nephesh," or the principle of vitality; "ruach," or the principle of motion; "nefchamah," or the power of intelligence; and "jehidah," a divine principle, by means of which it contemplates superior natures, and even ascends to the *Enfophic* world. All souls were produced at once, and pre-existed in Adam. Every human soul has two guardian angels, produced by emanation, at the time of the production of souls. The mind of man is united to the divine mind, as the radius of a circle to its centre. The souls of good men ascend above the mansion of angels, and are delighted with the vision of the first light, which illuminates all the world.

The doctrine of the Arabians, stated by Al-Gazel, is, that the souls of men are immortal, and that their bodies will be raised from the dead. In the interval between death and the resurrection, souls remain in an intermediate state; and after the resurrection the good and faithful shall be rewarded, and the wicked and unbelieving shall be punished; but they who, after having suffered punishment, shall confess one God, will, through his favour, be released from their confinement, and placed among the blessed.

The Cartesians make thinking the essence of the soul; and, from this principle, deduce its immateriality and immortality. But, according to Mr. Locke, &c. the principle is false; nor is there any need to define the soul a substance that thinks, to prove it immortal. It is enough that the soul be capable of thinking, and that it produce its own thoughts,

thoughts, without making thinking its essence. It is no more essential to the soul to think than to will; for a thing I can conceive the soul without, cannot be its essence.

Again, if thought be the essence of the soul, as a thing cannot produce itself, its own being, or essence; the soul does not produce its own thoughts, nor its own will: and thus it is brought to the condition of brutes, or even of inanimate bodies, without any action, any liberty, &c.

If the Cartesians only mean this of the faculty of thinking, they do wrong even to call this the essence of the soul. It is no more its essence than the faculty of willing is. And we conceive something in the soul prior to both those faculties.

The soul is a spiritual substance, proper to inform or animate a human body: and, by its union with this body, to constitute a reasonable animal or man. This is its essence, and this its definition.

It must be owned, the Cartesians prove the spirituality and immortality of the soul, from its thinking, exceedingly well; but they are not to have the honour of this proof as their own invention. All the great philosophers used it before them, and use it still.

For an account of Leibnitz's doctrine concerning the soul, see LEIBNITZ, LEIBNITZIAN *Philosophy*, MONAD, and *Pre-establiſhed HARMONY*.

Spinoza, and his followers, allowing only of one kind of substance, *viz.* matter; maintain the soul to be of the same substance with the body, *viz.* material. See SPINOZISM.

The doctrine of the materiality of the human soul has been adopted and maintained by several modern writers; and even by those who have distinguished themselves as able and zealous advocates in the cause of religion, both natural and revealed. In this number we may reckon Dr. Priestley, who, rejecting the commonly received notion of matter, (see MATTER,) as an absolutely impenetrable, inert substance, and premising, that the powers of sensation or perception, and thought, as belonging to man, have never been found but in conjunction with a certain organized system of matter, maintains, that those powers necessarily exist in, and depend upon, such a system. In proof of this doctrine, it is alleged, that perception and thought are not incompatible with the properties of matter, considered as a substance extended and endued with the powers of attraction and repulsion; and, therefore, if one kind of substance be capable of supporting all the known properties of man, true philosophy, which will not authorize us to multiply causes or kinds of substance, without necessity, will forbid us to admit of any substance in the constitution of human nature, essentially different from matter. The proper seat of the powers of perception and thought, according to this writer, is the brain; because, as far as we can judge, the faculty of thinking, and a certain state of the brain, always accompany and correspond to one another; and there is no instance of any man retaining this faculty, when his brain was destroyed; and whenever that faculty is impeded or injured, there is sufficient reason to believe that the brain is disordered in proportion. Dr. Priestley apprehends, that sensation and thought necessarily result from the organization of the brain, when the powers of mere life are given to the system, and that they follow of course, as much as the circulation of the blood follows respiration; but he professes to have no idea at all of the manner in which the power of perception results from organization and life.

To this reasoning it has been replied, in general, that Dr. Priestley's account of matter does not answer to the common ideas of matter, or that it is not solid extension, or an impenetrable and inert substance, which is the only matter that

is the object of natural philosophy; but something not solid, that exists in space, and so far agreeing with spirit; and consequently, if such matter is, as he asserts, the only matter possible, it will follow, not that we have no souls distinct from our bodies, but that we have no bodies distinct from our souls, and that all in nature is spirit. Besides, it has been farther urged, that a connection and dependence by no means prove sameness.

From the dependence of actual sensations and thought on the brain, we have no more reason to conclude that the brain is the mind, than a savage who had never heard the music of a harpsichord, and did not see the hand that played upon it, would have to conclude, that it played upon itself, and was the musician; because he could trace all the sounds to the instrument, and found that when the strings were out of order, the music was disturbed or destroyed. What experience teaches us is, that the exercise of the mental powers *depends* on the brain and the nerves; not that the mind *is* the brain and the nerves. We are sure the mind cannot be the brain, because the brain is an assemblage of beings; whereas the mind is one being.

It has been further objected by an anonymous writer (Edinb. Rev. N^o XVII.), that it is unphilosophical to class perception among the qualities of matter, when it is obvious, that it is by means of perception alone that we get any notion of matter or its qualities; and that it is possible, with perfect consistency, to maintain the existence of our perceptions, and to deny that of matter altogether. The other qualities of matter are perceived by us; but perception cannot be perceived; all we know about it is, that it is that by which we perceive every thing else. It sounds somewhat absurd and unintelligible, to say that perception is that quality of matter by which it becomes conscious of its own existence, and acquainted with its other qualities. It is plain that this is not a quality, but a knowledge of qualities; and that the percipient must necessarily be distinct from that which is perceived by it. We must always begin with perception; and the followers of Berkeley will tell us, that we must end there also. At all events, it certainly never entered into the head of any plain man to conceive, that the faculty of perception itself was one of the qualities with which that faculty made him acquainted; or that it could possibly belong to a substance, which his earliest intimations and most indelible impressions taught him to regard as something external and separate.

The following lines, if we may be allowed to avail ourselves of poetry in the illustration of a metaphysical question, forcibly express the universal and natural impression of mankind on this subject.

“Am I but what I seem, mere flesh and blood?
A branching channel, and a mazy flood?
The purple stream, that through my vessels glides,
Dull and unconscious flows like common tides.
The pipes, through which the circling juices stray,
Are not that thinking I, no more than they.
This frame, compacted with transcendent skill,
Of moving joints, obedient to my will,
Nursed from the fruitful glebe like yonder tree,
Waxes and waxes: I call it *mine*, not *me*.
New matter still the mouldering mass sustains;
The mansion changed, the tenant still remains,
And, from the fleeting stream repair'd by food,
Distinct, as is the swimmer from the flood.”

But, besides the impropriety of making the faculty of perception a quality of the thing perceived, and of absurdly converting our knowledge of the qualities of matter into another

another quality of the same substance, chargeable upon the doctrine of materialism, it is alleged that to call perception a *quality* at all, is a gross and unwarrantable abuse of language. Perception is an act or an event, a fact or a phenomenon, of which the percipient is conscious; but it cannot be intelligibly conceived as a quality; and, least of all, as a quality of that substance which is known to us as solid and extended. 1st. All the qualities of matter, it has been already stated, are perceived by the senses; but the sensation itself cannot be so perceived: nor is it possible to call it an object of sense, without the grossest perversion of expression. 2dly. All the qualities of matter have a direct reference to space or extension, and are conceived, in some measure, as attributes or qualities of the space within which they exist. When we say that a particular body is solid, we mean merely that a certain portion of space is impenetrable; when we say that it is coloured, we mean that the same portion of space appears of one hue,—and so of the other qualities: but sensation or thought is never conceived to occupy space, or to characterize it; nor can these faculties be at all conceived as definite portions of space, endued with perceptible properties. In the third place, all the primary qualities of matter are inseparable from it, and enter necessarily into its conception and definition. All matter must necessarily be conceived so extended, solid, and figured. It is obvious, however, that thought or sensation is not an inseparable attribute of matter, as by far the greater part of matter is entirely destitute of it; and it is found in connection with those parts which we term organized, only while they are in a certain state, which we call alive. If it be said, however, that thought may resemble those accidental qualities of matter, such as heat or colour, which are not inseparable or permanent; then we reply, that none of these things can properly be termed matter, more than thought or sensation; they are themselves substances, or matter possessed of inseparable and peculiar qualities, as well as those which address themselves to the other senses. Light is a material substance, from which the quality of colour is inseparable; and heat is a material substance, which has universally the quality of exciting the sensation of warmth. If thought be allowed to be a substance in this sense, it will remain to shew that it is material, by being referrible to space, and liable to attraction, repulsion, condensation or reflection, like heat or light.

Thought, as the advocates of materialism allege, is nothing else than motion; but, without attempting to define motion, it is sufficient to observe, that it is not a quality of matter; it is an act, a phenomenon, or a fact; but it makes no part of the description or conception of matter, though it only exists with reference to that substance. Let any man ask himself, however, whether the motion of matter bears any sort of resemblance to thought or sensation; or whether it be even conceivable that these should be one and the same thing? But, it is said, we find sensation always produced by motion; and as we can discover nothing else in conjunction with it, we are justified in ascribing it to motion. This is not the question. It is not necessary to inquire, whether motion may produce sensation or not, but whether sensation be motion, and nothing else. It seems pretty evident that motion can produce nothing but motion or impulse, and that it is at least as inconceivable that it should ever produce sensation in matter, as that it should produce a separate substance, called mind. But this is not the question with the materialists. Their proposition is, not that motion produces sensation, which might be as well in the mind as in the body; but that sensation is motion; and that all the phenomena of thought and perception are

intelligibly accounted for by saying, that they are certain little shakings in the pulpy part of the brain.

That sensation may follow motion in the brain, or may even be produced by it, is conceivable at least, and may be affirmed with perfect precision and consistency; but that the motion is itself sensation, and that the proper and complete definition of thought and feeling is, that they are certain vibrations in the brain, is a doctrine that can only be wondered at, and that must be comprehended before it be answered.

No advocate for the existence of mind, ever thought it necessary to deny that there was a certain bodily apparatus necessary to thought and sensation in man, and that on many occasions the sensation was preceded or introduced by certain impulses and corresponding movements of this material machinery; we cannot see without eyes and light, nor think without living bodies. All that they maintain is, that these impulses and movements are not feelings or thought, but merely the occasions of feeling and thought, and that it is impossible for them to confound the material motions which precede their sensations, with the sensations themselves, which have no conceivable affinity with matter.

Dr. Priestley farther argues, that all our ideas either proceed from the bodily senses, or are consequent upon the perceptions of sense; and hence infers, that the notion of the possibility of thinking in man, without an organized body, is not only destitute of all evidence from actual appearances, but is directly contrary to them. Moreover, if the mind was naturally so independent of the body, as to be capable of subsisting by itself, and even of appearing to more advantage after the death of the body, as some of the advocates for an intermediate state have maintained, it might, he says, discover some signs of its independence before its death, and especially when the organs of the body were obstructed, so as to leave the soul more at liberty to exert itself, as in a state of sleep or swooning, which most resemble the state of death, in which it is pretended that the soul is most of all alive, most active, and vigorous; but, judging by appearances, the reverse of all this is the case. Besides, if the mental principle was, in its own nature, immaterial and immortal, all its particular faculties would be so too; whereas we see that every faculty of the mind, without exception, is liable to be impaired, and even to become wholly extinct before death. Whence he infers, that the substance, or principle, in which these faculties exist, must be pronounced to be mortal too. He adds, if the sentient principle in man be immaterial, it can have no extension, but every thing within it, or properly belonging to it, must be simple and indivisible; and if this were not the case, the soul would be liable to corruption and death. But Dr. Priestley observes, that, whatever ideas are in themselves, they are evidently produced by external objects, and must therefore correspond to them; and since many of the objects or archetypes of ideas are divisible, it necessarily follows, that the ideas themselves are divisible also; and hence he infers, that the sentient principle in man, containing ideas which certainly have parts, and are divisible, and consequently having extension, cannot be that simple, indivisible, and immaterial substance, that some have imagined it to be; but something that has real extension, and therefore may have the other properties of matter. To this reasoning an excellent writer replies, that it would be as proper to assert that ideas are hard or round, as to assert that they are divisible. Perception is a single and indivisible act; and though the object perceived may be divisible, the perception of it by the mind cannot be so. Dr. Priestley farther adds, that

the soul possesses a great variety of mental affections, which necessarily imply alteration, especially melioration and depravation, which is something so similar to corruption, that it has universally obtained the same name, and which is certainly incompatible with natural and perfect simplicity. This writer alleges also, in favour of the system of materialism, that we hereby get rid of many difficulties, which must embarrass the opposite system; such, *e. gr.* as these—what becomes of the soul during sleep, in a swoon, when the body is seemingly dead (as by drowning, or other accidents), and especially after death? also what was the condition of it before it became united to the body, and at what time did that union take place? what are the nature and state of the souls of brutes? what is the use of the human body? &c. The system of materialism, he says, which revelation uniformly supposes, is clogged with no difficulties of this kind. Man, according to this system, is no more than what we now see of him. His being commences at the time of his conception, or perhaps at an earlier period. The corporeal and mental faculties, inhering in the same substance, grow, ripen, and decay together; and, whenever the system is dissolved, it continues in a state of dissolution, till it shall please that Almighty Being, who called it into existence, to restore it to life again. Accordingly the Christian system provides no reward for the righteous till the general resurrection of the just, nor any punishment for the wicked till the end of the world. Hence also the doctrine of the pre-existence of human souls, and that of the pre-existence of Christ, is rejected, as having no other foundation than the notion of there being something in man quite different from his corporeal organized system.

Dr. Priestley argues in many parts of his work on the supposition, that, according to the ideas of modern immaterialists, spirit can have no relation to place, and is incapable of being present any where. But Dr. Clarke, and some others of the best modern writers, did not entertain these ideas of spirit. Time and place are necessary to the existence of all things; and hence Dr. Clarke infers, that infinite space and duration are the essential properties of the Deity. Sir Isaac Newton was also of the same opinion; and Dr. Price observes, that if spirit exists at all, it must exist somewhere, as well as in some time.

Dr. Priestley deduces another argument in favour of the material system, from the consideration, that spirit and body have no common property, and that it must, therefore, be impossible for them to act upon one another: against which it has been objected, that his principles tend to prove, that the Deity is material, as well as all inferior beings: and if matter be a power of attraction and repulsion united to extension, the Deity must be the same. But if this maxim be not universally true, and the Deity be immaterial, as Dr. Priestley himself asserts, it will follow, that spirit may act upon matter, without having any other common property with it than being locally present to it; and one of his chief arguments for the materiality of the soul will be given up. Besides, allowing this maxim, how is it possible to avoid asserting the impossibility of the creation of the world out of nothing? For what common property can the Creator have with *nothing*? Dr. Priestley has laboured to prove, that the scriptures, both of the Old and New Testament, suppose and inculcate the doctrine of the uniform composition of man, or of the materiality of the human soul; and that, in conformity to this doctrine, the state of retribution does not take place till after the general resurrection. Accordingly, his system leads him to deny the natural immortality of the soul, and its conscious existence in the intermediate

state. To those who object, that if the soul be not naturally capable of surviving the body, or if death is unavoidably its destruction, then the resurrection must be the resurrection of a non-entity; he replies, that though the power of thinking cannot exist without its substance, which is an organized system, yet if this property of thinking necessarily attends the property of life, nothing can be requisite to the restoration of all the powers of the man, but the restoration of the body to a state of life. And he apprehends that a resurrection properly so called (because this can be only a resurrection of something that had been dead, *viz.* the body), is manifestly useless, upon the supposition of there being a soul distinct from the body; it being, upon this hypothesis, the soul, and not the body, that is the seat of all perception, and the source of all action. See *SLEEP of the Soul*.

Dr. Priestley conceives, that the three doctrines of materialism, of that which is commonly called Socinianism, and of philosophical necessity, are equal parts of one system, being equally founded on just observations of nature, and fair deductions from the scriptures; and that whosoever shall duly consider their connection and dependence on one another, will find no sufficient consistency in any general scheme of principles that does not comprehend them all. But it has been urged by another able writer, that if man be the matter itself which constitutes the man, and not its form or arrangement, as Dr. Priestley allows, the man will always remain while the matter which constitutes him remains, however different its organization or arrangement may be: that since death does not destroy the matter which constitutes man, it does not destroy the man; and that, consequently, he goes on to exist after death, or is naturally immortal: that, in order to the resurrection of the same man, the same matter must arise; and that it is no less possible for man to have existed *before* his birth, than it is, that he should exist *after* his death; and that, consequently, all the support to the Socinian scheme, which Dr. Priestley derives from his sentiments of materialism, falls to the ground. To this reasoning, however, he replies, that the pre-existence of the materials of the man Jesus is a very different kind of pre-existence from that of those who make Christ, or rather the principal part of him, to have pre-existed in an active state. We shall here subjoin the following argument, urged by the learned Dr. Clarke against Mr. Dodwell, in proof of the immateriality and natural immortality of the soul. That the soul cannot be material, he says, is demonstrable from the single consideration even of bare sense and consciousness itself. For matter being a divisible substance, consisting always of separable, nay, of actual separate and distinct parts; it is plain, unless it were essentially conscious, in which case every particle of matter must consist of innumerable separate and distinct consciousnesses, no system of it in any possible composition or division, can be an individual conscious being: for suppose three, or three hundred particles of matter, at a mile, or any given distance, one from another, is it possible that all those separate parts should, in that state, be one individual conscious being? Suppose, then, all these particles brought together, into one system, so as to touch one another, will they, thereby, or by any motion or composition whatsoever, become any whit less truly distinct beings than they were at the greatest distance? How then can their being disposed in any possible system, make them one individual conscious being? If you suppose God by his infinite power superadding consciousness to the united particles, yet still those particles, being really and necessarily as distinct beings as ever, cannot be themselves the subject in which

which that individual consciousness inheres; but the consciousness can only be superadded by the addition of something, which, in all the particles, must still itself be but one individual being. The soul, therefore, whose power of thinking is undeniably one individual consciousness, cannot possibly be a material substance. See on the subject of this article, Brucker's History of Philosophy, by Enfield. Priestley's Disquisitions relating to Matter and Spirit, 8vo. 1777. Correspondence between Dr. Price and Dr. Priestley, 8vo. 1778. Clarke's Demonstration of the Being and Attributes of God. Answer to Dodwell. Controversies with Collins; and Letters between him and Leibnitz. Butler's Analogy, chap. i. Baxter's Matho, vol. i. Enquiry into the Nature of the human Soul, &c. vol. i.

The notions of the ancients were very various with regard to the seat of the soul, and the mode of its action on the body. Some have maintained, that it is equally diffused through every part of it; and others say, that whilst it influences and acts upon every part of the body, it has its principal residence in some particular part. Since it has been discovered, by the improvements in anatomy, that the nerves are the instruments of perception, and of the sensations accompanying it, and that the nerves ultimately terminate in the brain, it has been the general opinion of philosophers that the brain is the seat of the soul; and that it perceives the images that are brought there, and external things, only by means of them. Des Cartes, observing that the *PINEAL Gland* (which see) is the only part of the brain that is single, all the other parts being double, and thinking that the soul must have one seat, was thus determined to make that gland the soul's habitation; to which, by means of the animal spirits, intelligence is brought of all objects that affect the senses. See *CARTES* and *CARTESIANISM*.

Others have not thought proper to confine the habitation of the soul to the pineal gland, but to the brain in general, or to some part of it, which they call the "sensorium." Even the great Newton favoured this opinion, though he proposes it only as a query, with that modesty which distinguished him no less than his great genius.

"Is not," says he, "the sensorium of animals the place where the sentient substance is present, and to which the sensible species of things are brought through the nerves and brain, that there they may be perceived by the mind present in that place? And is there not an incorporeal, living, intelligent, and omnipresent Being, who, in infinite space, as if it were in his sensorium, intimately perceives things themselves, and comprehends them perfectly, as being present to them; of which things, that principle in us which perceives and thinks, discerns only in its little sensorium, the images brought to it through the organs of the senses?" His great friend Dr. Clarke adopted the same sentiments with more confidence. In his papers to Leibnitz, we find the following passages. "Without being present to the images of the things perceived, the soul could not possibly perceive them. A living substance can only there perceive when it is present, either to the things themselves, (as the omnipresent God is to the whole universe,) or to the images of things, (as the soul of man is in its proper sensory). Nothing can any more act, or be acted upon, where it is not present, than it can be where it is not. We are sure the soul cannot perceive what it is not present to, because nothing can act, or be acted upon, where it is not." See *SENSORIUM*.

Mr. Locke expresses himself in such a manner, that, for the most part, one would imagine, that he thought the ideas, or images, of things, which he believed to be the immediate objects of perception, are impressions upon the mind itself;

yet in some passages he rather places them in the brain, and makes them to be perceived by the mind there present. From such passages, cited by Dr. Reid (*ubi infra*), it may be inferred, that he thought there are images of external objects conveyed to the brain. But whether he thought, with Des Cartes and Newton, that the images in the brain are perceived by the mind there present, or that they are imprinted on the mind itself, is not obvious. This hypothesis is founded on three assumptions; and if any one of them fail, it must fall to the ground. 1. That the soul has its seat, or, as Mr. Locke calls it, its presence-room, in the brain: 2. That images are formed in the brain of all the objects of sense: 3. That the mind or soul perceives those images in the brain; and that it perceives not external objects immediately, but only perceives them by means of those images. The first assumption is not sufficiently established to warrant our founding other principles upon it. Of the second there is no proof or probability, with regard to any of the objects of sense. The brain has been dissected times innumerable, by the nicest anatomists; every part of it has been examined by the naked eye, and with the help of microscopes; but no vestige of any external object was ever found. The brain seems to be the most improper substance that can be imagined for receiving or retaining images, being a soft, moist, medullary substance. The third assumption is as improbable, as that there are images of external objects in the brain to be perceived. If our powers of perception, says Dr. Reid, be not altogether fallacious, the objects we perceive are not in our brain, but without us. Reid's Essay on the Intellectual Powers of Man, Ess. ii. ch. 4. See *PERCEPTION*.

Borri, a Milanese physician, in a letter to Bartholine, "De Ortu Cerebri, et Ulu Medico," asserts, that in the brain is found a very subtle fragrant juice, which is the principal seat or residence of the reasonable soul; and adds, that the subtlety and fineness of the soul depends on the temperature of this liquor rather than on the structure of the brain, to which it is usually ascribed. This liquor, we conceive, must be the same with what is usually called the *nervous juice*, or *animal spirits*: the constitution of which is, doubtless, of great importance, with regard to the faculties of the soul.

Mr. Locke distinguishes two principal faculties or powers of the rational or human soul, *viz. perception* and *willing*. See *POWER*.

To these, other philosophers add others; as *sensation*, *liberty*, *memory*, *imagination*, and *habit*.

The mystic divines distinguish two principal parts of the soul: the *superior part*, which comprehends the understanding and the will, and the *inferior part*, which comprehends imagination and sensation.

As to the soul of brutes, the Cartesians, and some others, deny its existence in the common sense of the word soul; that is, they strip it of all the properties or faculties of the human soul: and the Peripatetics, on the contrary, invest it with the greatest part, if not all of them.

In man, a particular agitation of the fibres of the brain is accompanied with a sensation of heat; and a certain flux of animal spirits towards the heart and viscera is followed by love or hatred.

Now the Peripatetics maintain, that brutes feel the same heat, and the same passions, on the same occasions; that they have the same aversion for what incommodes them; and, in the general, are capable of all the passions, and all the sensations we feel.

The Cartesians deny they have any perceptions or notices at all, that they feel any pain or pleasure, or love or hate any thing.

thing. The ground of their opinion is, that they allow of nothing in brutes but what is material : and that they deny sensations and passions to be any properties of matter.

Some of the Peripatetics, on the other hand, maintain matter, when subtilized, framed, ranged, and moved, in a certain manner, to be capable of sensation and passion ; that beasts may feel and perceive, by means of the animal spirits, which are a matter thus modified ; and that even the human soul itself only becomes capable of sensation and passion by means of it.

The maintainers of the contrary opinion urge that appearance of sense, of fear, caution, love for their young, admirable sagacity, both for their own preservation and that of their species, visible through the whole brute creation. And it is true, that all the actions of beasts plainly express an understanding, for every thing that is regular expresses it, even a machine or watch expresses it, and a plant much more ; the radicle of the seed turning downwards, and the stem upwards, whatever situation the seed is sown in ; the young plant knitting from space to space to strengthen it, its putting forth prickles, &c. to defend it, &c. mark a great understanding. All the motions of plants and brutes plainly discover an intelligence ; but the intelligence does not reside in the matter thereof ; it is as distinct from the beast or plant, as that which ranged the wheels of the watch is distinct from the watch itself.

For, in effect, this intelligence appears infinitely great, infinitely wise, infinitely powerful ; and the same which formed us in our mother's womb, which gave us our growth, &c. Thus, in brutes there is not either understanding or soul, in the sense we generally use the word ; they eat without pleasure, cry without pain, grow without knowing it. They fear nothing, know nothing ; and if they act in such manner as shews understanding, it is because God, having made them, to preserve them, has formed their bodies so as to avoid whatever might hurt them mechanically.

Otherwise it might be said, that there is more understanding in the vilest insect, nay, in the smallest grain, than in the most knowing men ; for it is evident, either of them contains more parts, and produces more regular motions and actions, than we are capable of understanding. Thus does the great F. Malebranche argue against the souls of brutes. (*Recherche de la Verité*, liv. vi.) On this subject, see BRUTES and INSTINCT.

In connection with the interesting subject of this article, we shall here introduce some appropriate observations of an acute and elegant writer. (See Stewart's *Elements of the Philosophy of the Human Mind*.) This writer agrees with Dr. Reid in supposing, that the notions we annex to the words matter and mind, are merely relative. If I am asked, says he, what I mean by matter ? I can only explain myself by saying, it is that which is extended, figured, coloured, moveable, hard or soft, rough or smooth, hot or cold ; that is, I can define it in no other way, than by enumerating its sensible qualities. It is not matter or body which I perceive by my senses ; but only extension, figure, colour, and certain other qualities, which the constitution of my nature leads me to refer to something which is extended, figured, and coloured. The case is precisely similar with respect to mind. We are not immediately conscious of its existence, but we are conscious of sensation, thought, and volition ; operations, which imply the existence of something which feels, thinks, and wills. Every man too is impressed with an irresistible conviction, that all these sensations, thoughts, and volitions, belong to one and the same being ; to that being which he calls *himself* ; a being which he is led,

by the constitution of his nature, to consider as something distinct from his body, and as not liable to be impaired by the loss or mutilation of any of his organs. From these considerations it appears, that we have the same evidences for the existence of mind, that we have for the existence of body ; nay, if there be any difference between the two cases, that we have stronger evidence for it ; inasmuch as the one is suggested to us by the subjects of our consciousness, and the other merely by the objects of our perception. But as from our earliest years the attention is engrossed with the qualities and love of matter, these phenomena occupy our thoughts more than those of the mind, and we are perpetually tempted to explain the latter by the analogy of the former, and even to endeavour to refer them to the same general laws ; and we acquire habits of inattention to the subjects of our consciousness, not easily surmounted. If, therefore, our notions of mind and matter are merely relative ; if we know the one, only by such sensible qualities as extension, figure, and solidity, and the other, by such operations as sensation, thought, and volition, we are warranted in saying, that matter and mind, considered as objects of human study, are essentially different ; the science of the former resting ultimately on the phenomena exhibited to our senses, and that of the latter, on the phenomena of which we are conscious. Instead, therefore, of objecting to the scheme of materialism, that its conclusions are false, it would be more accurate to say, that its aim is unphilosophical. It proceeds on a misapprehension of the proper object of science ; the difficulty which it professes to remove being manifestly placed beyond the reach of our faculties. Surely, when we attempt to explain the nature of that principle which feels, and thinks, and wills, by saying, that it is a material substance, or that it is the result of material organization, we impose on ourselves by words, forgetting that matter as well as mind is known to us by its qualities and attributes alone, and that we are totally ignorant of the essence of either. Should it be said that the unknown substance which has the qualities of extension, figure, and colour, may be the same with the unknown substance which has the attributes of feeling, thinking, and willing ; this is only an hypothesis, which amounts to nothing more than a mere possibility ; and even if it were true, it would no more be proper to say of mind that it is material, than to say of body that it is spiritual.

SOULS, *Cure of*. See CURE.

SOULS, *Migration of*. See MIGRATION and METEMPSYCHOSIS.

SOUL, *Sleep of the*. See SLEEP of the Soul.

SOUL-SCOT, a certain fee paid by our Saxon ancestors to the priest on opening a grave.

SOUL'S CHEAT, a legacy anciently bequeathed at their deaths by our scrupulously pious ancestors, to the parish-priest, to compensate for any tithes that might have been forgot in their lives.

SOULAINES, in *Geography*, a town of France, in the department of the Aube, and chief place of a canton, in the district of Bar-sur-Aube ; 12 miles N. of Bar-sur-Aube. The place contains 763, and the canton 7723 inhabitants, on a territory of 265 kilometres, in 21 communes.

SOULAMEA, in *Botany*, slightly altered from *Soulamoe*, the name given to the plant in the island of Ternate. Lamarck Dict. v. 1. 449. Jull. 429. This is no other than what we have described under the article REX AMARORIS, to which we refer the reader. Commerfon, it seems, gathered this curious plant at Port Praslin, in the Arsacides. Lamarck describes the flowers with a three-cleft calyx, three petals, six stamens, and two stigmas. The germen is superior.

Fruit

Fruit an inverfely heart-shaped *capsule*, compressed, dilated at the margin, of two cells, each containing an oval *seed*; but it often happens that one of thefe feeds is abortive.

SOULANCOURT, in *Geography*, a town of France, in the department of the Upper Marne; 4 miles E. of Bourmont.

SOULE, a small country of France, fo called before the revolution, fituated between Bearn and Navarre, of which Mauleon was the capital, now in the department of the Lower Pyrenées.

SOULLIERES, a town of France, in the department of Mont Blanc; 20 miles E. of St. Jean de Maurienne.

SOULONA, a town of Thibet; 20 miles E.S.E. of Coucour-Hotun.

SOULTZ, a town of France, in the department of the Upper Rhine, and chief place of a canton, in the diftrict of Colmar. The place contains 4298, and the canton 9317 inhabitants, on a territory of $87\frac{1}{2}$ kilometres, in 9 communes.

SOULZ-SOUS-FORETS, a town of France, in the department of the Lower Rhine, and chief place of a canton, in the diftrict of Wissembourg; 2 miles S. of Wissembourg. The place contains 1269, and the canton 13,768 inhabitants, on a territory of 145 kilometres, in 26 communes.

SOUM, in *Agriculture*, a term denoting the palturage of a full-grown cow. It is moftly applied to lands in the moory ftate, and fuch as are under the fheep-walk fyftem. It nearly answers, in fome refpects, to *gaite*. It is much ufed in the northern parts of Scotland. In the county of Perth, a horfe is accounted two founs; in fome places four fheep, but in other places five, are eftimated at one foun; and of young cattle according to their age. The grafs of a foun, in hilly ground, is valued, on an average, from five to feven fhillings, according to its quality. By fome, much cenfure has been beftowed on this mode of afcertaining the value of pallure or grafs-land in the Highlands: but in mountainous diftricts, where the ground has never been meafured, and probably never will, where one mountain is exactly different from another in the quality and quantity of its produce as a pallure, and where there is even a great diverfity in different regions of the fame mountain, it is perhaps not eafy to conceive a better method of afcertaining the value of pallure than by the number of cattle it can maintain. Whoever propofes to explode any old cuftom, ought, it is fuppofed, to fubftitute a better in its place.

Such old cuftoms are now, however, a great deal more neglected and difregarded, even in thefe Highland fituations, than was formerly the cafe; juft in the fame manner as the term *gaite* has partially grown into difufe in different diftricts in the fouthern parts of the kingdom.

SOUMENZAC, in *Geography*, a town of France, in the department of the Lot and Garonne; 7 miles N.W. of Lauzun. N. lat. $44^{\circ} 41'$. E. long. $0^{\circ} 27'$.

SOUND, *SONUS*, a perception of the foul, communicated by means of the ear; or the effect of a collision of bodies, and a tremulous motion confequent upon it, communicated thence to the circumambient fluid, and propagated through it to the organs of hearing.

Sound is not fimply a vibration or undulation of the air, as fome have called it, for there are many founds in which the air is not concerned, as when a tuning-fork or any other founding body is held by the teeth: nor is found always a vibration or alternation of any kind, for every noife is a found, and a noife, as diftinguifhed from a continued found, confifts of a fingle impulfe in one direktion only, fometimes without

any alternation; while a continued found is a fuceffion of fuch impulfes, which, in the organ of hearing at leaft, cannot but be alternate. If thefe fuceffive impulfes form a connected ferief, following each other too rapidly to be feperately diftinguifhed, they conftitute a continued found, like that of the voice in fpeaking; and if they are equal among themfelves in duration, they produce a mufical or equable found, as that of a vibrating chord or ftring, or of the voice in finging. Thus, a quill ftriking againft a piece of wood caufes a noife, but ftriking againft the teeth of a wheel or comb, a continued found; and if the teeth of the wheel are at equal diftances, and the velocity of the motion is conftant, a mufical note.

To illuftrate the caufe of found, we obferve, firft, that a motion is neceffary in the fonorous body for the production of found. Secondly, that this motion exifts, firft, in the fmall and infenfible parts of the fonorous bodies; and is excited in them by their mutual collision and percuffion againft each other, which produces that tremulous motion fo obfervable in bodies that have a clear found, as bells, mufical chords or ftrings, &c. Thirdly, that this motion is communicated to, or produces a like motion, ufually in the air, or fuch parts of any material fubftance as are fit to receive and propagate it, inafmuch as no motion of bodies, at a diftance, can affect our fenfes, without the mediation of other bodies, which receive thofe motions from the fonorous body, and communicate them immediately to the organ. Laftly, that this motion muft be communicated to thofe parts that are the proper and immediate inftruments of hearing. See EAR.

Further, that motion of a fonorous body which is the immediate caufe of found, may be owing to two different caufes: either the percuffion between it and other hard bodies, as in drums, bells, ftrings, &c. or the beating and dafhing of the fonorous body and the air immediately againft each other, as in wind-inftuments, flutes, trumpets, &c.

But, in both cafes, the motion, which is the confequence of the mutual action, and the immediate caufe of the fonorous motion which the air conveys to the ear, is an invifible, tremulous, or undulating motion, in the fmall and infenfible parts of the body.

To explain this, all fenfible bodies are fuppofed to confift of a number of fmall and infenfible parts or corpufcles, which are of the fame nature in all bodies, and are perfectly hard and incompressible.

Of thefe are compofed others, fomewhat greater, but ftill infenfible; and thefe different, according to the different figures and union of their component parts. Thefe, again, conftitute other mafles, bigger and more different than the former; and of the various combinations of thefe laft, are thofe grofs bodies compofed that are vifible, tangible, &c. The firft and fmalleft parts, we have obferved, are abfolutely hard; the others are compressible, and are united in fuch manner, that, being compressed by an external impulfe, they have an elastic or reftitutive power, by which they reftore themfelves to their natural ftate.

A fhock, then, being made by one body upon another, the fmall particles, by their elastic principle, move to and again with a very great velocity, in a tremulous, undulating manner, fomewhat like the vifible motions of groffer fprings; as we eafily obferve in the ftrings of mufical inftruments. And this is what we may call the *fonorous motion*, which is propagated to the ear; but obferve, that it is the infenfible motion of thofe particles next the fmalleft, which is fuppofed to be the immediate caufe of found; and, of thefe,

only those next the surface communicate with the air, the motion of the whole, or of the greater parts, being no farther concerned, than as they contribute to the other.

To apply this theory, strike a bell with any hard body, and you easily perceive a sensible tremor on the surface, spreading itself over the whole, and that more sensibly as the shock is greater. Upon touching it in any other part, the motion and the sound too are stopped. Now this is apparently a motion of the small and insensible parts, changing their situation, with respect to one another; which being to many, and so closely united, we cannot perceive their motions separately and distinctly; but only a trembling, which we reckon to be the effect of the confusion of an infinite number of little particles, closely joined, and only moving in infinitely little lines.

M. Perrault adds, that the visible motion of the parts contributes no otherwise to sound, than as it causes the invisible motion of the smaller parts, which he calls *particles*, to distinguish them from the sensible ones, which he calls *parts*, and from the smallest of all, which we call *corpuscles*.

This he supports from the instance of a chord or string, which being struck, and the sound, and sensible undulations, at rest again, if you approach the chord softly with the finger, you will find a small tremulous motion, which is the remains of the vibrations of the whole string and the parts. Now the parts vibrate without any sound; but no sooner is the vibration felt by the finger, than the sound is heard again; which he ascribes to this, that the motion of the parts being insufficient to move the particles, whose motion is the first that ceases, requires some assistance from dashing against the finger, whereby to become enabled to give the particle the motion necessary for the producing of sound. He finishes his proof by the instance of flutes, which, when made of different matters, as wood, metal, &c. whose parts are very different, but their particles nearly the same, if their lengths and bore be the same, there is very little sensible difference in their sounds.

The sonorous body having made its impression on the contiguous air, that impression is propagated from one particle to another, according to the laws of pneumatics.

A few particles, for instance, driven from the surface of the body, drive their neighbouring particles into a less space; and the medium, as it is thus rarefied in one place, becomes condensed in the other; but the air, thus compressed in the second place, is, by its elasticity, returned back again, both to its former place and its former state; and the air contiguous to that is compressed; and the like obtains, when the air less compressed expanding itself, a new compression is generated. From each agitation of the air, therefore, there arises a motion of the air, analogous to the motion of a wave on the surface of the water; which we call a *wave*, or *undulation* of air.

In each wave the particles go and return back again, through very short, but equal spaces; the motion of each particle is analogous to the motion of a vibrating pendulum, while it performs two oscillations; and most of the laws of the pendulum, with very little alteration, are applicable thereto.

The only condition necessary for the production of a simple sound, is a sufficient degree of velocity in the motion or impulse which occasions it. A very moderate velocity must be sufficient for producing an impression on the ear; and when the sound is continued, it may remain audible with a velocity of no more than one hundredth part of an inch in a second, or perhaps with a velocity much less than this; but at its origin, it is probable that the velocity of the motion

constituting a sound must always be considerably greater. A continued sound may be produced by a repetition of separate impulses, independent of each other, as when a wheel strikes in rapid succession the teeth of a pinion, so as to force out a portion of air from between them; when a pipe, through which air is passing, is alternately opened and shut, either wholly or partially, by the revolution of a stop-cock or valve; or when a number of parallel surfaces is placed at equal distances, in a line nearly perpendicular to them, and a noise of any kind is reflected from each of them in succession:—a circumstance which may often be observed, when we are walking near an iron railing, an acute sound being heard, which is composed of such reflections from the surfaces of the palisades. See SOUND, in *Music, infra*.

Sounds are as various as are the means that concur to their production. The principal varieties result from the figure, constitution, quantity, &c. of the sonorous body; the manner of percussion, with the velocity, &c. of the vibrations consequent thereon; the state and constitution of the medium; the disposition, distance, &c. of the organ; the obstacles between the organ and the sonorous object, and the adjacent bodies. The most notable distinction of sounds, arising from the various degrees and combinations of the conditions mentioned, are into *loud* and *low* (or strong and weak); into *grave* and *acute* (or sharp and flat, or high and low); and into *long* and *short*: the management of which makes the office of music. See the next article.

M. Euler is of opinion, that no sound, making fewer vibrations than 30, or more than 7520 in a second, is distinguishable by the human ear. According to this doctrine, the limit of our hearing, as to acute and grave, is an interval of eight octaves. Tentam. Nov. Theor. Mus. cap. i. sect. 13.

The velocity of sound is the same with that of the aerial waves, and does not differ much, whether it go with the wind or against it. By the wind, indeed, a certain quantity of air is carried from one place to another; and the sound is accelerated, while its waves move through that part of the air, if their direction be the same as that of the wind. But as sound moves much more swiftly than wind, the acceleration it will hereby receive is inconsiderable; and the chief effect we can perceive from the wind is, that it increases and diminishes the space of the waves, so that by help of it the sound may be heard to a greater distance than otherwise it would. See WIND, & *infra*.

That the air is the ordinary medium of sound, and that the presence of this, or of some other material substance for its transmission is necessary, appears from various experiments in rarefied and condensed air. In an unexhausted receiver, a small bell may be heard at some distance; but when exhausted, it can scarcely be heard at the smallest distance. If the air be condensed, the sound will be louder proportionably to the condensation, or quantity of air crowded in, of which we have many instances in Mr. Hauksbee's experiments. From these experiments (Phil. Trans. 1709, xxiv. 1902, 1709, xxvi. 367, 371.) it appears, that a bell was heard at the distance of 30 yards, when the air was in its common state, at 60 with the force of two atmospheres, at 90 with the force of three: beyond this the intensity did not much increase.

Besides, sounding bodies communicate tremors to distant bodies; *e. g.* the vibrating motion of a musical string puts others in motion, whose tension and quantity of matter dispose their vibrations to keep time with the pulses of air, propagated from the string that was struck. Galileo explains this phenomenon by observing, that a heavy pendulum

lum may be put in motion by the least breath of the mouth, provided the blatts be often repeated, and keep time exactly with the vibrations of the pendulum, and also by the like art in raising a large bell.

Dr. Priestley constructed an apparatus in order to ascertain whether the intensity of sound is affected by any other property of the air in which it is made besides its mere density. The result of his experiments with different kinds of air was, that the intensity of sound depends solely upon the density of the air in which it is made, and not at all upon any chemical principle in its constitution. In inflammable air the sound of the bell he used was hardly to be distinguished from the same in a pretty good vacuum; and this air is ten times rarer than common air. In fixed air the sound was much louder than in common air, so as to be heard about half as far again; and this air is in about the same proportion, denser than common air. In dephlogisticated air the sound was also sensibly louder than in common air. Experiments and Observations, &c. vol. v. p. 296, &c.

But it is not the air alone that is capable of the impressions of sound, but water also, as is manifest by striking a bell under water, the sound of which may plainly enough be heard, only not so loud, and also a fourth deeper, according to good judges in musical notes. And Mersenne says, a sound made under water is of the same tone or note as if made in air, and heard under water.

It does not appear that any direct experiments have been made on the velocity with which an impulse is transmitted through a liquid, although it is well known that liquids are capable of conveying sound without difficulty. Professor Robison informs us, that he heard the sound of a bell transmitted by water, at the distance of 1200 feet. It is easy to calculate the velocity with which sound must be propagated in any liquid, of which the compressibility has been measured. Mr. Canton has ascertained, that the elasticity of water is about 22,000 times as great as that of air: it is, therefore, measured by the height of a column, which is in the same proportion to 34 feet, that is 750,000 feet; and the velocity corresponding to half this height is 4900 feet in a second. In mercury also, it appears from Mr. Canton's experiments, that the velocity must be nearly the same as in water; in spirit of wine a little smaller. The experiments were made by filling the bulb of a thermometer with water, and observing the effects of placing it in an exhausted receiver, and in condensed air; taking care to avoid changes of temperature, and other sources of error. The fluid rose in the tube when the pressure was removed, and subsided when it was increased. A slight correction, however, is necessary, on account of the expansion and contraction of the glass, which must have tended to make the elasticity of the fluids appear somewhat greater than it really was. See COMPRESSION.

The least elastic substance that has been examined is perhaps carbonic acid gas, or fixed air, which is considerably denser than atmospherical air, exposed to an equal degree of pressure. The height of the atmosphere, supposed to be homogeneous, is, in ordinary circumstances, and at the sea-side, about 28,000 feet; and in falling through half this height, a heavy body would acquire a velocity of 946 feet in a second. But from a comparison of the accurate experiments of Derham, made in the day-time, with those of the French academicians, made chiefly at night, the true velocity of sound is about 1130 feet in a second; which agrees very nearly with some observations made with great care by professor Pictet. This difference between calculation and experiment, which has long occupied the attention

of natural philosophers, has been in a great measure removed by the suggestion of La Place, who has attributed the effect to the elevation of temperature, which is always found to accompany the action of condensation, and to the depression produced by rarefaction. When the density of the air is changed, while its elasticity remains unaltered, which happens when it is expanded by heat, or condensed by cold, the height of the column, and consequently the velocity, will also be altered; so that for each degree of Fahrenheit's thermometer, the velocity will vary about one part in a thousand. Bianconi has actually observed this difference of velocity according to the different heights of the thermometer, and it may be shewn less directly by means of the sounds of pipes; but it has not been accurately determined whether or not the correction, on account of the effect of compression in causing heat, remains unaltered, although Bianconi's experiments agree very well with the supposition that no material change takes place in this respect. The velocity of sound must also be, in some measure, influenced by the quantity of moisture contained in the atmosphere: it must be a little diminished by cold fogs, which add to the density, without augmenting the elasticity; and increased by warm vapours, which tend to make the air lighter: and these two opposite states are probably often produced in succession, in wind instruments blown by the mouth; the air within them being at first cold and damp, and afterwards warm and moist.

In pure hydrogen gas, the velocity of sound ought, from calculation, to be more than three times as great as in common air; but the difference does not appear to have been so great in any experiment hitherto made on the sounds of pipes, in gases of different kinds. For such experiments, the comparative specific gravity of the gas may be most conveniently ascertained by Mr. Leslie's method of observing the time employed in emptying a vessel through a small orifice, by means of the pressure of an equal column of water; according to the simple theory, the velocities of the gas thus discharged ought to be in the same proportion as the respective velocities with which sounds would be transmitted by them: and if any variation from this proportion were discovered, it must be attributed to the different degrees of heat produced by condensation in the different fluids. Steam, at the temperature of boiling water, is only one-third as heavy as common air; consequently the velocity of sound in steam must be nearly three-fourths greater than in air.

A certain time is always required for the transmission of an impulse through a material substance, even through such substances as appear to be the hardest, and the least compressible. It is demonstrable that all minute impulses are conveyed through any homogeneous elastic medium, whether solid or fluid, with an uniform velocity, which is always equal to that which a heavy body would acquire by falling through half the height of the modulus of elasticity, that is, in the case of the air, half the height of the atmosphere, supposed to be of equal density; so that the velocity of sound, passing through an atmosphere of an uniform elastic fluid, must be the same with that of a wave moving on its surface. In order to form a distinct idea of the manner in which sound is propagated through an elastic substance, we must first consider the motion of a single particle, which, in the case of a noise, is pushed forwards, and then either remains stationary, or returns back to its original situation; but, in the case of a musical sound, is continually moved backwards and forwards, with a velocity always varying, and varying by different degrees, according to the nature or quality of the tone: for instance, differently in the notes of
a bell

a bell and of a trumpet. We may first suppose, for the sake of simplicity, a single series of particles to be placed only in the same line with the direction of the motion. It is obvious, that if these particles were absolutely incompressible, or infinitely elastic, and were also retained in contact with each other by an infinite force of cohesion or of compression, the whole series must move precisely at the same time, as well as in the same manner. But in a substance which is both compressible and extensible or expansible, the motion must occupy a certain time in being propagated to the successive particles on either side, by means of the impulse of the first particle on those which are before it, and by means of the diminution of its pressure on those which are behind; so that when the sound consists of a series of alternations, the motion of some of the particles will be always in a less advanced state than that of others nearer to its source; while at a greater distance forwards, the particles will be in the opposite stage of the undulation; and still further on, they will again be moving in the same manner with the first particle, in consequence of the effect of a former vibration.

It is well known, that solid bodies in general are good conductors of sound: thus, any agitation communicated to one end of a beam is readily conveyed to the ear, applied to the other end of it. The motion of a troop of cavalry is said to be perceived at a greater distance, by listening with the head in contact with the ground, than by attending to the sound conveyed through the air; and we may frequently observe, that some parts of the furniture of a house are a little agitated by the approach of a waggon, before we hear the noise which it immediately occasions. The velocity, with which impulses are transmitted by solids, is in general considerably greater than that with which they are conveyed by the air. Mr. Wunsch has ascertained this by direct observations on a series of deal rods closely united together, which appeared to transmit a sound instantaneously, while a sensible interval was required for its passing through the air. He also found that the blow of a hammer on a wall, at the upper part of a high house, is heard as if double by a person standing near it on the ground; the first sound descending through the wall, the second through the air. It appears from experiments on the flexure of solid bodies of all kinds, that their elasticity, compared with their density, is much greater than that of the air: thus, the height of the modulus of elasticity of fir wood is found, by means of such experiments, to be about 9,500,000 feet; whence the velocity of an impulse conveyed through it must be 17,400 feet, or more than three miles, in a second. It is obvious, therefore, that in all common experiments, such a transmission must appear perfectly instantaneous. There are various methods of ascertaining this velocity from the sounds produced under different circumstances, by the substances to be examined; and professor Chladni has, in this manner, compared the properties of a variety of natural and artificial productions.

Sound may be propagated not only in single right lines, or in parallel lines, but usually the impulse that occasions it, more especially when sound is transmitted through a fluid, spreads in every direction, so as to occupy at any one time nearly the whole of a spherical surface. It is impossible, however, that the whole of this surface should be affected in a similar manner by any sound, originating from a vibration confined to a certain direction, since the particles behind the sounding body must be moving towards the centre, whenever the particles before it are retreating from the centre; so that in one half of the surface, the motions may be called retrograde or negative, while in the other they are direct or positive: consequently at the sides,

where these portions join, the motions can neither be positive nor negative, and the particles must remain at rest: the motions must also become gradually less and less sensible, as they approach to the limit between the two hemispheres. This statement may be confirmed by an experiment on the vibration of a body, of which the motion is limited to a certain direction; the sound being scarcely audible, when the ear is in a direction precisely perpendicular to that of the vibration. The sound, thus diverging, must always be spread through a part of a spherical surface, because its velocity must be equal in every direction; so that the impulse will always move forwards in a straight line passing through the centre of the sphere, or the vibrating body. But when a hemispherical pulse arrives at the surface of a plane solid obstacle, it is reflected, precisely in the same manner that a wave of water is reflected, and assumes the form of a pulse proceeding from a centre at an equal distance on the opposite side of the surface. This reflection, when it returns back perpendicularly, constitutes what is commonly called an *echo* (which see): but in order that the echo may be heard distinctly, it is necessary that the reflecting object be at a distance moderately great, otherwise the returning sound will be confused with the original one; and it must either have a smooth surface, or consist of a number of surfaces arranged in a suitable form: thus there is an echo not only from a distant wall or rock, but frequently from the trees in a wood, and sometimes, as it is said, even from a cloud.

If a sound or a wave be reflected from a curved surface, the new direction which it will assume may be determined, either from the condition that the velocity with which the impulse is transmitted must remain unaltered, or from the law of reflection, which requires that the direction of the reflected pulse or wave be such as to form an angle with the surface, equal to that which the incident pulse before formed with it. Thus, if a sound or wave proceed from one focus of an ellipse, and be reflected at its circumference, it will be directed from every part of the circumference towards the other focus; since the distance which every portion of the pulse has to pass over in the same time, in following this path, is the same, the sum of the lines drawn from the foci to any part of the curve being the same; and it may also be demonstrated that these lines form always equal angles with the curve on each side. (See ELLIPSE.) If an ellipse be prolonged without limit, it will become a *parabola* (which see); hence a parabola is the proper form of the section of a tube, calculated for collecting a sound which proceeds from a great distance into a single point, or for conveying a sound nearly in parallel directions to a very distant place. It appears, therefore, that a parabolic conoid is the best form for a hearing trumpet, and for a speaking trumpet. See TRUMPET.

The decay of sound is the natural consequence of its distribution throughout a larger and larger quantity of matter, as it proceeds to diverge every way from its centre. The actual velocity of the particles of the medium transmitting it appears to diminish simply in the same proportion as the distance from the centre increases; consequently their energy, which is to be considered as the measure of the strength of sound, must vary as the square of the distance; so that, at the distance of ten feet from the sounding body, the velocity of the particles of the medium becomes one-tenth as great as at the distance of one foot; and their energy, or the strength of the sound, only one-hundredth as great. Young's Lect. on Nat. Phil. vol. i. lect. 31.

The space through which sound is propagated, in a given time, has been very differently estimated by authors who have

have written concerning this subject. Roberval gives it at the rate of 560 feet in a second; Gallendus, at 1473; Merfenne, at 1474; Du Hamel, in the History of the Academy of Sciences at Paris, at 1172; the Academy del Cimento, at 1148; Boyle, at 1200; Roberts, at 1300; Walker, at 1338; fir Isaac Newton, at 968; Dr. Derham, in whose measure Mr. Flamsteed and Dr. Halley acquiesced, at 1142.

The reason of which variety Dr. Derham ascribes partly to some of those gentlemen using strings and plummet, instead of regular pendulums; and partly to there not being distance enough between the sonorous body and the place of observation; and partly to there being no regard had to the winds: Derham having found the effects of the wind, though not of any changes of weather.

But by the accounts since published by M. Cassini de Thury, in the Memoirs of the Royal Academy of Sciences at Paris for the year 1738, where cannon were fired at various as well as great distances, under great variety of weather, wind, and other circumstances, and where the measures of the different places had been settled with the utmost exactness, sound was propagated at a medium at the rate only of 1038 French feet in a second. The French foot exceeds the English by nearly seven lines and a half, or is as 107 to 114; and consequently 1038 French feet are equal to 1106 or 1107 English feet. The difference, therefore, of the measures of Dr. Derham and M. Cassini is 34 French, or 36 English feet, in a second. According to this last measure, the velocity of sound, when the wind is still, is settled at the rate of a mile, or 5280 English feet in $4\frac{2}{3}$ seconds.

According to Mayer, the velocity of sound in a second is 1105 feet; according to Müller, 1109; and according to Piçet, about 1180. According to Bianconi (C. Bon. ii. i. 365.), in summer, the thermometer being at 20°, 70 vibrations of the pendulum elapsed while a sound passed over 13 miles; in winter, 79 seconds, the thermometer being at 12°. In a cloud or mist, 155" elapsed while the sound passed and repelled. Hence the air should expand $\frac{1}{100}$ for 21.2°, or $\frac{1}{100}$ for 1° of the thermometer employed, probably Reaumur's, which is $\frac{1}{100}$ for 1° of Fahrenheit. The mean difference of the temperature of the air was probably somewhat less than is supposed, perhaps 17° or 18°.

Chladni infers, from the longitudinal vibrations of different substances, a velocity of 7800 feet in a second in tin, 9300 in silver, 12,500 in copper, 17,500 in glass and iron, 11,000 to 18,000 in wood, and 10,000 to 12,000 in tobacco-pipes. These observations are fully confirmed from different grounds. According to the elasticity of fir, as inferred from an experiment of Mr. Leslie, the velocity of an impulse should be 17,300. The velocity may be easily calculated from the sound of a brass-rod: if the number of vibrations of the gravell found in a second be n , the velocity will be $978 \frac{n l}{d}$, l being the length, and d the depth

in feet. From an experiment of this kind, Dr. Young says (Lect. on Phil. vol. ii. p. 266.) that he found the velocity 17,700 in crown glass, and 11,800 in brass.

Some of the most considerable queries, relating to the laws of sounds, have been proposed by Dr. Derham; and he answered several of them accurately, from experiments made for that purpose by himself, as follows:

How far does a sound move in a second of time? Sound moves 1142 feet, or 380 yards in a second, which is just an English mile in $9\frac{1}{4}$ or 9.25 half seconds; two miles in $18\frac{1}{2}$;

three miles, or a league, in $27\frac{3}{4}$, &c.; and about 13 miles in one minute.

But sea-miles are to land-miles nearly as 7 to 6; and, therefore, sound runs a sea-league in about 12 seconds of time. It is a common observation, that persons in good health have about 75 pulsations, or beats, of the artery at the wrist, in a minute; consequently, in 75 pulsations, sound flies about 13 land-miles, and about $11\frac{1}{2}$ sea-miles, which is about one land-mile in six pulses, and about one sea-mile in near seven pulses, or a league in 20 pulses. And hence the distance of objects may be found, by knowing the time which sound takes to move from those objects to an observer: *E. g.* upon seeing the flash of a gun at sea, if 56 beats of the pulse at the wrist were counted before the report was heard, the distance of that gun may be easily found by dividing 56 by 20, which gives 2.8 leagues, or about eight miles.

Does the report of a gun, discharged with its mouth towards us, come sooner than when the muzzle is from the observer? By repeated experiments it appears, there is no difference in the sound from this different direction.

Do sounds move in the same time, through the same spaces, in all states of the atmosphere, and heights of the barometer, by day and by night, in summer and in winter, in snowy and in clear weather, in this or that climate? By repeated experiments, it does not appear there arises any difference from any of these different circumstances.

Do the winds affect the motion of sounds? By repeated experiments, it appears, there is some, though a very small difference, in the velocity of sounds, with or against the wind; which is also augmented or diminished by the strength or weakness of the wind.

Do a great and intense sound, and a small or languid one, move with the same velocity? It appears that they do.

For by experiments, a cannon fired with a half-pound charge of powder, was heard at about the distance of $17\frac{1}{2}$ miles, in the same time after the flash was seen, as when fired with a charge of six pounds.

Does the sound of a gun move equally swift at all elevations of the gun? It does.

Do different quantities or strengths of gunpowder occasion any difference as to the velocity of the sound? None.

Does sound move in a right line the nearest way, or does it sweep along the earth's surface? And is there any difference in the time, if the piece be discharged in an acclive and a declive position? Sound moves the nearest way; and the velocity appears to be the same in acclivities as in declivities.

Have all kinds of sounds, as those of guns, bells, &c. the same velocity? And are sounds equally swift in the beginning of their motion and in the end? There appears no inequality in either of these respects; and, therefore, the times in which sound is heard are proportional to the distance; that is, at a double distance it is heard in twice the time, &c.

SOUND, for the Reflection, Refraction, &c. of. See ECHO and PHONICS.

SOUNDS, Articulate. See ARTICULATE.

SOUND, in Music, denotes a quality in the several agitations of the air, considered as their disposition, measure, &c. may make music or harmony.

Musical sounds are most frequently produced by the alternate motions of substances naturally capable of isochronous vibrations; which substances may be either solids or fluids, or instruments composed of a combination of fluids with solids. The resonance of a room or passage is one of the

the simplest sources of a musical sound; the walls being parallel, the impulse is reflected backwards and forwards continually, at equal intervals of time, so as to produce the effect of a musical sound. When we blow obliquely and uniformly into a cylindrical pipe closed at one end, the impulse or condensation must probably travel to the bottom and back, before the resistance is increased; the current of our breath will then be diverted from the mouth of the pipe, for an equal time, which will be required for the diminution of the resistance by the discharge of the condensed air, so that the whole time of a vibration will be equal to the time occupied by an impulse of any kind in passing through four times the length of the pipe. An open pipe may be considered nearly as if it consisted of two such pipes, united at their closed ends; the portions of air contained by them being agitated by contrary motions, so as always to afford each other a resistance similar to that which the bottom of the stopped pipe would have furnished. It is probable, says Dr. Young, that when an open pipe is once filled with air a little condensed, the oblique current is diverted, until the effect of the discharge, beginning at the remoter end, has returned to the inflated orifice, and allowed the current to re-enter the pipe. Where the diameter of the pipe is different at different parts of its length, the investigation of the sound becomes much more intricate; but it has been pursued by M. Daniel Bernouilli with considerable success, although upon suppositions, says Young, not strictly consistent with the actual state of the motions concerned.

In the same manner as an open pipe is divided by an imaginary basis, so as to produce the same sound with a stopped pipe of half the length, a pipe of any kind is capable of being subdivided into any number of such pipes, supposed to meet each other's corresponding ends only; and in general the more violently the pipe is inflated, the greater is the number of parts into which it subdivides itself, the frequency of the vibrations being always proportional to that number. Thus, an open pipe may be divided not only into two, but also into four, six, eight, or more portions, producing the same sounds as a pipe of one-half, one-third, one-fourth, or any other aliquot part of the length; but a stopped pipe cannot be divided into any even number of similar parts; its secondary sounds being only those of a pipe of which the proportion is determined by the odd numbers, its length being, for example, one-third, one-fifth, or one-seventh of the original length. These secondary notes are sometimes called harmonics; they are not only produced in succession from the same pipe, but they are also often faintly heard together, while the fundamental note of the pipe continues to sound. When the pipe has a large cavity connected with it, or consists principally of such a cavity, with a small opening, its vibrations are usually much less frequent, and it is generally incapable of producing a regular series of harmonics.

It is obvious, from this statement of the analogy between the velocity of sound and the vibrations of the air in pipes, that they must be affected in a similar manner by all alterations of temperature. Thus, the frequency of the vibrations of a pipe must be increased nearly in the ratio of 33 to 34 by an elevation of 30 degrees of Fahrenheit's thermometer; and if this change be accompanied by a transition from dampness to simple moisture, the sound will be still more altered.

Dr. Chladni has discovered that solids of all kinds, when of a proper form, are capable of longitudinal vibrations, exactly resembling in their nature those of the air in an organ-pipe, having also their secondary or harmonic notes related to them in a similar manner. These vibrations are

always far more frequent than those of a column of air of equal length, the velocity with which an impulse is transmitted by a solid of any kind, being usually from 5 to 16 times as great as the velocity of sound in air; so that the longitudinal sounds are always extremely acute, when they are produced by substances of moderate length. These sounds afford perhaps the most accurate mode of determining the velocity of the transmission of an impulse through any elastic substance, and of obtaining from that velocity the exact measure of its elasticity: they may be easily exhibited by holding a long bar or wire of iron or brass in the middle, and striking it at one end with a small hammer in the direction of its length.

The vibrations by which solid bodies most usually produce sound, are, however, not longitudinal, but lateral, and they are governed either by a tension, derived from the operation of a weight, or of some other external force, or by the natural elasticity of the substance. The vibrations of extended substances resemble most in their properties those of elastic fluids, and they occur the most frequently in practice, although the vibrations produced by the elasticity of the substance may be considered as the most natural. See STRING and VIBRATION.

Sound is the object of music; which is nothing but the art of applying sounds, under such circumstances of tone and time, as to raise agreeable sensations.

The principal affection of sound, by which it becomes fitted to have this end, is that by which it is distinguished into *acute* and *grave*.

This difference depends on the nature of the sonorous body; the particular figure and quantity of it; and even, in some cases, on the part of the body where it is struck; and this is that which constitutes what we call *different tones*.

The cause of this difference appears to be no other than the different velocities of the vibrations of the sounding body. In effect, the tone of a sound is found, by abundance of experiments, to depend on the nature of those vibrations, whose difference we can conceive no otherwise than as having different velocities; and since it is proved, that the small vibrations of the same chord or string are all performed in equal time, and that the tone of a sound, which continues for some time after the stroke, is the same from first to last, it follows, that the tone is necessarily connected with a certain quantity of time in making each vibration or each wave; or that a certain number of vibrations or waves, accomplished in a given time, constitute a certain and determinate tone. From this principle are all the phenomena of tune deduced.

If the vibrations be isochronous, the sound is called musical, and is said to continue at the same pitch; and is said to be acuter, sharper, or higher, than any other sound, whose vibrations are slower and graver, and flatter or lower, than any other whose vibrations are quicker. See UNISON.

From the same principle arise what we call *concord*s, &c. which are nothing but the results of frequent unions and coincidences of the vibrations of two sonorous bodies, and consequently of the waves and undulating motions of the air occasioned by them.

On the contrary, the result of less frequent coincidences of those vibrations is what we call a *discord*.

Another considerable distinction of sound, with regard to music, is that by which they are denominated *long* and *short*; not with regard to the sonorous body's retaining a motion, once received, a longer or a less time, though gradually growing weaker, but to the continuation of the impulse

impulse of the efficient cause on the sonorous body, for a longer or shorter time, as in the notes of a violin, &c. which are made longer or shorter by strokes of different length or quickness.

This continuity is properly a succession of several sounds, or the effect of several distinct strokes, or repeated impulses, on the sonorous body, so quick that we judge it one continued sound, especially if it be continued in the same degree of strength; and hence arises the doctrine of *measure* and *time*.

Sounds, again, are distinguished, with regard to music, into *simple* and *compound*, and that two ways. In the first, a sound is said to be compound, when a number of successive vibrations of the sonorous body, and the air, come so fast upon the ear, that we judge them the same continued sound; as in the phenomenon of the circle of fire, caused by putting the fire-end of a stick in a quick circular motion; where, supposing the end of the stick in any point of the circle, the idea we receive of it there continues till the impression is renewed by a sudden return.

A simple sound then, with regard to this composition, should be the effect of a single vibration, or of so many vibrations as are necessary to raise in us the idea of sound. In the second sense of composition, a simple sound is the product of one voice, or one instrument, &c.

A compound sound consists of the sounds of several distinct voices or instruments, all united in the same individual time and measure of duration, that is, all striking the ear together, whatever their other differences may be. But in this sense, again, there is a two-fold composition; a natural and an artificial one.

The natural composition is that proceeding from the manifold reflections of the first sound from adjacent bodies, where the reflections are not so sudden as to occasion echoes, but are all in the same tune with the first note.

The artificial composition, which alone comes under the musician's province, is that mixture of several sounds, which being made by art, the ingredient sounds are separable and distinguishable from one another. In this sense the distinct sounds of several voices or instruments, or several notes of the same instrument, are called simple sounds, in contradistinction to the compound ones, in which, to answer the end of music, the simples must have such an agreement in all relations, chiefly as to acuteness and gravity, as that the ear may receive the mixture with pleasure.

Another distinction of sounds with regard to music is that, by which they are said to be *smooth* and *even*, or *rough* and *harsh*, also *clear* and *hoarse*: the cause of which differences depends on the disposition and state of the sonorous body, or the circumstances of the place; but the ideas of the differences must be sought from observation.

Smooth and rough sounds depend principally on the sounding body; of these we have a notable instance in strings that are uneven, and not of the same dimension or constitution throughout.

M. Perrault, to account for roughness and smoothness, maintains, there is no such thing as a simple sound; but that the sound of the same chord or bell is a compound of the sounds of the several parts of it; so that where the parts are homogeneous, and the dimensions or figure uniform, there is always such a perfect mixture and union of all the sounds, as makes one uniform and smooth sound: contrary conditions produce harshness. In effect, a likeness of parts and figure make an uniformity of vibrations, by which a great number of similar and coincident motions conspire to fortify and improve each

other, and unite, for the more effectual producing of the same effect.

This account he confirms from the phenomenon of a bell, which differs in tone according to the part it is struck in; and yet strike it any where, there is a motion over all the parts. Hence he considers the bells as composed of an infinite number of rings, which, according to their different dimensions, have different tones, as chords or strings of different lengths have; and when struck, the vibrations of the parts immediately struck specify the tone, being supported by a sufficient number of consonant tones in other parts. This must be allowed, that every note of a stringed instrument is the effect of several simple sounds; for there is not only the sound resulting from the motion of the string, but that from the motion of the parts of the instrument, which has a considerable effect in the total sound, as is evident from hence, that the same string on different violins sounds very differently.

But Perrault affirms the same of every string itself, and without considering the instrument. Every part of the string, he says, has its particular vibrations, different from the gross and sensible vibrations of the whole; and these are the causes of different motions and sounds in the particles, which uniting compose the whole sound of the string, and make an uniform composition, in which the tone of the particular part struck prevails, and all the others mix under a due subordination with it, so as to make the composition smooth and agreeable. If the parts be unevenly or irregularly constituted, the sound is harsh; which is the case in what we call *false* strings, and various other bodies, which, for this reason, have no certain and distinct tone, but a composition of several tones, which do not unite and mix, so as to have one predominant to specify the total tone.

As to clear and hoarse sounds, they depend on circumstances that are accidental to the sonorous body; thus, a voice and instrument will be hollow and hoarse, if raised within an empty hoghead, that yet is clear and bright out of it; the effect is owing to the mixture of other and different sounds, raised by reflections, which corrupt and change the species of the primitive sounds.

For sounds to be fit to obtain the end of music, they ought to be smooth and clear, possessing especially the first quality: since, without this, they cannot have one certain and discernible tone, capable of being compared to others, in a certain relation of acuteness, of which the ear may judge, and of consequence they can be no part of the object of music.

Upon the whole then, with Mr. Malcolm, we call that an *harmonic* or *musical* sound, which, being clear and even, is agreeable to the ear, and gives a certain and discernible tune (hence called *tunable* sound), which is the subject of the whole theory of harmony.

Dr. Burney, in the discussion of the subject of this article, observes, that enquiries concerning the absolute production and modification of sound belong to physics; whereas a musician only examines sounds comparatively one with the other, and considers their proportions and relation as divided into concords and discords. (See CONCORD, DISCORD, and RELATION.) And it is only in this light, he says, that we shall consider sound in the residue of this article. We shall examine sound under three different heads; the tone, the force, and the quality of tone. Under these heads, sound admits of modification: first, from grave to acute; secondly, loud and soft; thirdly, harsh and sweet, or dull and brilliant.

We shall first establish it as a principle, that whatever is the cause of sound, its vehicle is the circumambient air; because

because the air is the only medium of which we are certain, between the sounding body and the organ of hearing: that we must not multiply bodies unnecessarily, as the air is sufficient to explain the formation of sound; and it is found by an exhausted receiver, that sound cannot be produced without air.

The continuance or permanence of sound can only be occasioned by the agitation of the air. As long as this agitation continues, the tremulous motion of the air is communicated to the ear, and likewise prolongs the sensation of sound. And there is no way more simple of accounting for the duration of sound, than in supposing that the succession of vibrations continues to renew the impression. Further, this agitation of the air, of whatever kind it may be, can only be produced by a similar agitation in the several parts of the sounding body; and it is a certain fact, that these several parts of a sounding body are in constant vibration as long as it continues to sound. If we touch the body of a violoncello, or any instrument, while it is sounding, we feel it tremble under the hand, and we may even see the string tremble as long as it sounds. It is the same with a bell caused to sound by a blow of the clapper, we may feel and see it tremble; and grains of sand, if sprinkled on its surface, will be seen to jump and skip. If a string is relaxed, or a bell cracked, there is no longer either sound or vibration. If, therefore, neither the bell nor the string can communicate to the air no motion but such as they have themselves, there can be no doubt but that sound is produced by the vibrations of the sounding body, and is propagated by similar vibrations, which this tremulous body communicates to the air.

This being supposed, let us first examine what constitutes the ratio of sound, with respect to grave and acute.

Rousseau, in his article *Son*, sound, repeats all the experiments for measuring and comparing sound with sound, which we have given, and shall give, under the different heads of tuning glasses by water, see *ARMONICA*; strings by weight; by moveable bridges, see *MONOCHORD*; by the number of vibrations, see *RATIO*; by the relative length, thickness, and tension of a string, which see; by the beats of organ-pipes, see *BEAT*; by the holes in flutes and hautbois, which serve to shorten the tube; by the different columns of air, which form the different tones of horns and trumpets: these are all upon the same principle as the sons harmoniques of the violin and violoncello. See *HARMONICS*.

The second point to be considered in analysing sound, is its force, which depends on the vibrations of the sounding body: the more powerful and strong these vibrations are made, the more vigorous and audible is the sound. A certain limited degree of force can only be given to a pipe or string, beyond which all its proportions are broken, and its tone rendered false and disagreeable to the ear. The velocity of sound has been considered by the most eminent philosophers and mathematicians; but the result of their enquiries and experiments have materially varied. Halley and Flamsteed make sound move, in England, 1070 Fr. feet in a second; and La Condamine 174 toises in Peru; while Merfennus and Gassendi assure us that the wind being favourable or contrary, neither accelerates nor retards the motion of sound. But since the experiments of Derham (Phil. Transf.), and the Academy of Sciences at Paris, former calculations are regarded as erroneous.

Without slackening its pace, sound becomes weaker by extent from the place of its production; but if not checked by any obstacle, nor repressed by the wind, it generally moves in the ratio of the squares of the distance.

Thirdly, as to the difference of sound in the quality of tone, it certainly does not arise from its elevation in the scale, nor from its force. The tone of a flute and a hautbois, though perfectly in tune together, can never resemble each other. There will always be a softness and smoothness in the flute, and a spirit and agreeable vibration of the reed in the hautbois, which must ever prevent similarity; without mentioning the different tones of voices, by which individuals are as well recognized as by their features. See *VOICE*.

Rousseau says, a composer does not consider merely whether the sounds he uses are high or low, but whether they should be loud or soft, rough or smooth, dull or brilliant; and he distributes them to different instruments and voices accordingly; sometimes in solo parts, and sometimes in *tutti*, or full chorus; at the extremities or medium of instruments or voices in piano or forte, as the composition shall require.

For the appreciable extent of the musical scale or compass, it depends on our power of perception, though in nature it is infinite. Lengthen or shorten a musical string to a certain degree, and it produces no sound. We can neither augment nor diminish the compass of the flute at our pleasure, or the length or shortness of an organ-pipe; both have their limits. All appreciable sounds are comprised, according to Euler, within the numbers 30 and 7552. So that by the experiments of this great geometrician, the lowest sound of which we can ascertain the tone, makes 30 vibrations in a second, and the highest 7552 vibrations in the same time; an interval of nearly eight octaves. See *EULER*, and *COMPASS*.

In our present system of music, we have but one octave of twelve sounds, the rest are all replicates, recurrences, or repetitions of these twelve semitones in the octaves above and below; and if we could use all these octaves or recurrences of sound in the first octave, they amount in all to 96, which is the greatest number of practicable sounds in music, generated by one fundamental.

It is impossible to calculate, with similar precision, the number of practicable sounds in the music of the ancients. For the Greeks may be said to have formed as many systems of music, as they had different ways of tuning their tetrachords. It appears, in reading their treatises of music, that these different tunings amounted to an indefinite number, including all the changes of genus and mode which a new found or key would introduce. See *TETRACHORD*, and *SYSTEM of the ancient Greeks*.

With regard to the twelve sounds of the modern system, the tuning never changes, and they are always immoveable. Brossard pretends that they are moveable, founding his opinion of their being often altered by flats and sharps; but the changing the chord or string, or its sound, are different things.

SOUNDS, Harmonical. See *HARMONICS*.

The harmonical sounds, *viz.* the twelfth and seventeenth above the principal (as well as some others), have been long known to accompany every fundamental sound; and may naturally, and in general, be supposed to be produced by the partial or separate vibrations of the string or sonorous body, spontaneously dividing itself, according to a determinate law, into three, five, or other aliquot parts of the whole, considered as unity. The theory of M. Rameau, which has been so excellently illustrated by M. d'Alembert, in his *Elémens de Musique*, is founded on these harmonical sounds. See *FUNDAMENTAL Base*, *HARMONY*, and *SYSTEM*.

SOUNDS, Harmonic, denote also a singular kind of sounds, which are produced in certain instruments, such as the violin and violoncello, by a particular motion of the bow, and by placing

placing the finger lightly in certain divisions of the chord or string. On account of their sweetness, they are called *fluted* sounds. By sliding the finger lightly from sharp to flat, from the middle of a chord which is touched at the same time with the bow, we hear distinctly a succession of harmonic sounds from flat to sharp, which are very astonishing to those who are not acquainted with the theory. See *Sons Harmoniques*.

The principle on which this theory is founded is, that if a chord be divided into two parts which are commensurable with each other, and consequently with the whole chord, and the obstacle placed at the point of division obstructs, in an imperfect manner, the communication of the vibrations from one part to another; when it is sounded, it will not yield the sound of the entire chord, nor that of its greater part, but that of the smaller part, if it exactly measures the other; or if it does not measure it, the sound of the greatest aliquot common to these two parts. Let a chord, as 6, be divided into two parts, as 4 and 2, the harmonic sound will be produced by the small part, 2, which is the aliquot of the other, 4; but if a chord, as 5, be divided into two parts, as 2 and 3, then, as the small part does not measure the greater, the harmonic sound will proceed from the half, 1, of the small part; unit being the greatest common measure of the two parts 3 and 2, and of the whole chord 5. By means of this law, which is conformable to the experiments of M. Sauveur and of Dr. Wallis, it is easy, by a very simple calculation, to assign to each tone the harmonic sound which answers to it. Whilst the finger slides the length of the chord, we obtain a series of harmonic sounds, which succeed each other rapidly according to the order of the divisions of the chord, to which the finger is successively applied.

The first column of the following table exhibits the sounds which the divisions of the instrument would yield when touched full, and the second column shews the *fluted* sounds corresponding to them when the chord is touched harmonically.

TABLE of Harmonic Sounds.

The whole chord	} gives	the unison.
The minor third		the 19th, or double octave of the 5th.
The major third		the 17th, or double octave of the major third.
The fourth		the double octave.
The fifth		the 12th, or octave of the same 5th.
The minor sixth		the triple octave.
The major sixth		the 17th major, or double octave of the 3d.
The octave		the octave.

After the first octave, *i. e.* advancing from the middle of the chord towards the bridge, we shall have again the same harmonic sounds in the same order on the same divisions, *i. e.* the 19th on the minor 10th, the 17th on the major 10th, &c. *Encyclopédie*, art. *Harmoniques Sons*. See *HARMONICS*, and *HARMONY*.

SOUNDS, *Third*, denote those which are produced by sounding two notes at the same time, either on the same or on two different instruments; and which are almost always graver than the lowest of the two tones that generated them, and are their proper fundamental base.

The discovery of these sounds has been generally ascribed to Tartini, who published an account of them in his "Tratto di Musica, secundo la vera Scienza dell'Armonia," printed at Padua, 1754; but the *Encyclopédie*, art. *Harmonie*, attri-

butes the first discovery, though probably unknown to Tartini, to M. Romieu, of the Royal Society of Sciences of Montpellier, who published an account of it in a memoir in 1752.

The experiment may be made by founding the perfect interval of a 3d, 4th, or 5th, &c. either on two strings of the same violin, or on two violins played upon at the distance of about thirty feet, with a strong bow, and holding out the notes; or with two trumpets, hautbois, or German flutes; the hearer, in the last mentioned cases, playing himself in the middle of the interval between the two instruments. Thus, *e. gr.* the interval C *e*, or a major 3d, produces C, the octave below the lower note; C sharp *e*, a minor 3d, produces A, a tenth below the graver tone; B *e*, a 4th, gives E, the octave of the upper note; B *f* sharp, a 5th, produces an unison to B; B *g*, a 6th, generates the double octave below the upper note; and B flat *g*, or the major 6th, produces E flat, the 5th of the lower note, &c.

M. Tartini observes, that the third sound resulting from the 4th, from two 3ds, from two 6ths, whether major or minor, is the most easily distinguished, because this sound is always more grave than either of the two which produce it; that the third sound produced by the 5th is distinguished with greater difficulty, because it is an unison of a graver sound; and that it is more difficult to distinguish it in the tones major and minor, because these tones, differing little from one another, are easily confounded in the intonation; and for the same reason, with greater difficulty, in the semitones major and minor.

The author, in a song composed of two parts, discovers, by means of two corresponding sounds, the third sound resulting from them; and this, he says, is the true base of the song; and every other base will be a paralogism. From his experiments and reasoning he concludes, that if any adjoining two simple intervals in the harmonic series 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, &c. be sounded, the third sound will always be that of half the string; that the smaller the interval is, the farther distant is the third sound: so that, *e. g.* the third sound to the interval of the semitone minor G G sharp, is the 26th below G natural.

M. Serre, of Geneva, in his "Essai sur les Principes de l'Harmonie," printed at Paris in 1753, mentions this discovery of Tartini as a fact sufficiently ascertained; and adds, that he has produced the same effect by means of two fine female voices, as Tartini had done by instruments; but he mentions only the third sound produced by the third major, and that produced by the third minor: and there is this difference between the results of these two gentlemen. According to M. Tartini, the two sounds of a third major, as *ut mi*, produced the octave *ut* below *ut*; and according to M. Serre, a double octave: according to the former, the two sounds of a third minor, *la ut*, produced the tenth major, *fa* below *la*; but according to the latter, the seventeenth major below *la*, or the octave under the tenth *fa*. M. Serre takes no notice of a third sound produced by any other two sounds, and it does not appear that he made any trials of this kind.

As to the physical cause of these third sounds, it is much more difficult to offer any plausible conjectures concerning it, than concerning the harmonical notes mentioned in the preceding article; because all those of the latter kind being more acute than the principal, or generating tone, are, for that reason, capable of being actually and immediately produced by the vibrations of certain portions of the string or other sounding body; whereas, in the third sounds, a tone is heard always (except in the case of the fifth), and often

considerably below the pitch of either of the bodies whose vibrations it accompanies, and which consequently cannot immediately proceed from either of these bodies. To take the first of the above-mentioned intervals, that of the greater third, for an example: a third sound is here heard, such as would be produced by the actual vibration of a string of the same diameter and tension with, but of double the length of, that which produced the lowest note of the interval. As no such string, however, is employed in the experiment, we are obliged to seek for the cause of this new sound in the air, or other medium of sound, or in the organ of hearing, or in some internal modification of the sensitive faculty.

As the immense variety of our sensations of colour is justly supposed to be produced by an equal diversity of coloured particles of light, each highly qualified to excite one particular sensation and no other, so some, with M. Mairan, have supposed, that our numerous and diversified sensations of musical tones are not produced by the undulations of the air, considered in its whole mass, but by aerial particles, specifically different in elasticity, magnitude, figure, &c. each capable of exciting, by its motions or other modifications, the idea of only one determinate tone. Therefore we might say, that the two orders of particles which give the tones C and *e*, either by an harmonical congruity in their spring with that set of particles which give the third sound C below, or by some other peculiar affinity to them, are qualified, by their joint action on these last-mentioned particles, to give them that particular modification, by which they excite in us the sensation of that specific tone to which they are adapted. Or, may we not conceive in general, that a mixture of two given tones may excite the idea of a third and different sound, in some such manner as two given colours, *e. g.* blue and yellow; nay, the past impressions of these colours excite the idea of green, different from both of them.

But if the effect is produced merely by the organ of hearing, we may observe, that, from a consideration of the spiral and conical structure of the cochlea, some physiologists have been tempted to imagine, that the branches or filaments of the auditory nerve, after passing out from the nucleus or axis of the cochlea, are strained upon the spiral plates, like the radii of a circle, and become gradually shorter and shorter toward its apex. It may be supposed likewise, that of these nervous strings, the longest, which are in the basis of the cochlea, are adapted to receive the tremors or other impressions, and convey to the mind the ideas, of grave tones; and the shorter nervous chords, fixed more towards the apex of the cone, those of acute sounds. This being allowed, and taking the former interval C *e* for an example, it may be said that the tone C, besides acting on the nervous chord appropriated to excite the idea of that tone, must act likewise on another nervous chord of double its length, situated towards the basis of the cochlea, &c. and which is naturally adapted to receive and transmit to the mind C, the octave below; but which the upper tone C now divides into two equal parts, each giving tones unison to the said note C. The tone *e*, in like manner, will excite five equal vibrations in each of the halves of this nervous chord; all which, likewise, produce sensations unison with itself. These phenomena at least are invariably observed to be produced in musical strings. Thus we obtain the unisons to C and *e*: and farther, the last-mentioned chord thus vibrating in two and in ten parts, and from one extremity of it to the other, may fairly be supposed to vibrate in its whole length; in which case it must excite in the mind the idea of its own fundamental tone, the third sound C, an octave below the first of these notes, and a tenth below the latter. See, on the sub-

ject of this article, Encyclopédie, art. *Basse FONDAMENTALE*. Principles and Power of Harmony, 4to. 1771, and Monthly Rev. vol. xlv. p. 371, &c.

SOUND, in *Geography*, denotes a strait or inlet of the sea, between two capes or head-lands.

The Sound is used, by way of eminence, for that famous strait which joins the German sea to the Baltic.

It is situate between the island of Zealand and the coast of Schonen. It is about sixteen leagues long, and in general five broad, excepting against the castle of *Cronenburg*, (which see,) where it is but one; so that there is there no passage for vessels but under the cannon of the fortrefs.

This was first erected for the better commanding of the Sound, as was also *Helsingburgh*, on the opposite shore in Schonen, for the protection of ships from pirates, then numerous in that sea.

This has given occasion to the Danes to settle a toll on all vessels, which is said to be one of the best revenues of the crown of Denmark; and to forbid all pilots from pailing through the Great and Little Belt, which are two other inlets into the Baltic, though somewhat less commodious than the former.

All nations who traffic into this part of the North are subject to this toll: the Swedes, indeed, were exempted from it by the treaty of 1644, but by the treaty of 1720, they are excluded the privilege, and put on the same footing with their neighbours.

By the treaty of Spire, made between the Danes and Charles V. in behalf of his Netherland subjects, the toll for this passage was fixed at two rose nobles for a ship of two hundred tons; yet, in the year 1640, the same was raised to upwards of five hundred rix-dollars.

The connivance of our king James I. who had married a daughter of Denmark, and the wars which the Hollanders had been long engaged in for their liberty, furnished the occasion for so grievous an exaction. Of late years, the toll has been again reduced to an easier footing.

Cromwell was bent on extorting this passage from the Danes, and had probably effected it, but that, before the fleet for that purpose arrived there, he died.

However, in 1659, England, Holland, and France, by treaty, obliged Denmark to stipulate, that it shall never be increased upon the said three nations, who are mutual guarantees to this treaty.

The origin and progress of this imposition (which, from an easy contribution, of which we have an account so early as 1348, voluntarily paid by merchants for maintaining lights on certain places of the coast, and for protection of ships from pirates, and of which the king of Denmark was only treasurer or trustee, grew at length to be a heavy burden on trade, as well as a kind of servile acknowledgment of his sovereignty of these seas) is given in lord Molesworth's Account of Denmark, chap. iii. p. 11. seq.

As to the present state of this toll, Dr. Busching, in his New Geography, observes, that it is on an equal footing with all nations, excepting the Hamburgers, who pay more than others: the English, Dutch, Swedish, and French ships, are not searched when provided with proper passes, according to treaties; and pay down only 1 per cent. for such goods as are not specified in the tariff. But all other nations pay 1½ per cent. and must submit to be searched. With regard to the Hanse Towns, on the Baltic, there is a great variety in the toll they pay, for almost every one of those towns is treated with in particular. See DENMARK and ELSINEUR.

On the Sound, accounts are kept in rix-dollars, of 4 orts, which contain 96 skillings Danish, or 48 skillings Hamburg

burgh money. The tolls paid at the passage of the Sound are reckoned in rix-dollars, Swedish specie, which are $12\frac{1}{2}$ per cent. better than crown money, and therefore $19\frac{7}{7}$ per cent. better than Danish currency; but this rix-dollar is $2\frac{2}{5}$ per cent. worse than the effective rix-dollar specie of 7 marks 6 skillings Danish currency. The tolls are also sometimes settled in crown money. In paying duties at the Sound, the shipping is reckoned for 300 lbs.; the stein or stone for 30 lbs.; the Russian berkowitz for 300 lbs.; and the pood for 30 lbs. Here are also certain regulations for foreign measures, an abstract of which is given in Kelly's Cambist.

SOUND, in the *Manege*. A horse is said to be found that does not halt. When a jockey feels a horse he warrants him found hot and cold; that is, that he does not halt either when you mount him or when he is heated, nor yet after alighting, when he stands and cools.

SOUND, an instrument which surgeons introduce through the urethra into the bladder, in order to discover whether there is a stone in this viscus or not. The found is usually made of very highly polished steel, that it may be well calculated for conveying to the surgeon's fingers, a sensation of any thing against which its end may strike. It is also generally less curved than a catheter, so that its end may be more easily inclined to the lower part of the bladder, where the stone is most frequently situated.

SOUND-BOARD, or *Wind-chest*, of an organ, is the principal part of that most noble and comprehensive instrument, and that which feeds all the pipes with wind. See **ORGAN**.

The found-board, or *fommier*, as it is called in France, is a reservoir, into which the wind drawn in by the bellows is conducted by a port-vent, and thence distributed into pipes placed over the holes of its upper part. The wind enters the pipes by valves, which are opened by pressing the keys, after drawing the registers by the stops, which prevent the air from going into any of the pipes, except those required. Organs, whose longest pipe in the diapason is four feet, have their found-board from five to six feet. Organs of sixteen feet have two found-boards, which communicate the wind from one to the other, by means of a pewter port-vent.

SOUND-HOLM, in *Geography*, one of the smaller Shetland islands, near the S.W. coast of Yell.

SOUNDING, in *Navigation*, the act of trying the depth of the water, and the quality of the bottom, by a line and plummet, or other artifice.

There are two plummets used for this purpose; one of which is called the hand-lead, weighing about 8 or 9 lbs. and the other the deep-sea lead, which weighs from 25 to 30 lbs. and both are shaped like the frustum of a cone or pyramid. The former is used in shallow waters, and the latter at a great distance from the shore, particularly on approaching the land after a sea voyage. Accordingly, the lines employed for this purpose are called the deep-sea lead-line and the hand-lead line. The hand-lead line, which is usually 20 fathoms in length, is marked at every 2 or 3 fathoms; so that the depth of the water may be ascertained either in the day or night: at the depth of 2 and 3 fathoms, there are marks of black leather; at 5 fathoms, there is a white rag; at 7, a red rag; at 10, and at 13, black leather; at 15, a white rag; and at 17, a red one.

Sounding with the hand-lead, which the seamen call heaving the lead, is generally performed by a man who stands in the main-chains to windward. Having the line all ready to run out, without interruption, he holds it nearly at the distance of a fathom from the plummet, and having swung the latter backwards and forwards three or four times, in order to acquire the greater velocity, he swings it round his head,

and thence as far forwards as is necessary; so that, by the lead's sinking whilst the ship advances, the line may be almost perpendicular when it reaches the bottom. The person sounding then proclaims the depth of the water in a kind of song, resembling the cries of hawkers in a city; thus, if the mark of 5 is close to the surface of the water, he calls, 'by the mark 5,' and as there is no mark at 4, 6, 8, &c. he estimates those numbers, and calls, 'by the dip 4, &c.' If he judges it to be a quarter or a half more than any particular number, he calls, 'and a quarter 5,' and 'a half 4,' &c. If he conceives the depth to be three-quarters more than a particular number, he calls it a quarter less than the next: thus, at 4 fathoms $\frac{3}{4}$, he calls, 'a quarter less 5,' and so on.

The deep-sea lead-line is marked with two knots at 20 fathoms, 3 at 30, 4 at 40, &c. to the end. It is also marked with a single knot at the middle of each interval, as at 25, 35, 45 fathoms, &c. To use this lead more effectually at sea, or in deep water on the sea-coast, it is usual previously to bring-to the ship, in order to retard her course: the lead is then thrown as far as possible from the ship on the line of her drift, so that as it sinks, the ship drives more perpendicularly over it. The pilot feeling the lead strike the bottom, readily discovers the depth of the water by the mark on the line nearest its surface. The bottom of the lead being also well rubbed over with tallow, retains the distinguishing marks of the bottom, as shells, ooze, gravel, &c. which naturally adhere to it.

The depth of the water, and the nature of the ground, which are called the foundings, are carefully marked in the log-book, as well to determine the distance of the place from the shore, as to correct the observations of former pilots. Falconer.

For a machine to measure unfathomable depths of the sea, see **ALTITUDE**.

SOUNDING the Pump, at Sea, is done by letting fall a small line, with some weight at the end, down into the pump, to know what depth of water there is in it.

SOUNDING, in *Surgery*, the operation of introducing the found. See **SEARCHING for the Stone**.

SOUNDIPOUR, in *Geography*, a town of Hindoostan, in Bahar, 8 miles S. of Rotalgur.

SOUNE, a small island in the Indian sea, near the coast of Africa. S. lat. $10^{\circ} 57'$.

SOUNISA, a town of Asiatic Turkey, in the government of Sivas; 27 miles N. of Tocat.

SOUNMEN HARIO HOTUN, or **SOUMEN Char**, a town of Chinese Tartary, in the province of Hami; 15 miles N.W. of Hami-Hotun.

SOUP, or **SOOP**, a kind of pottage made of bread, and broth, or of the juice of flesh, or other matters, usually served at the beginning of a meal.

The word is French, formed from the Italian, *zuppa*, or *suppa*, of the Latin, *sapa*, wine boiled away to a third part. Others derive it from the Celtic, *fouben*, which signifies the fame.

Soup is esteemed essential to a French dinner. Sometimes they heighten the relish by the addition of onions, or leeks, or cabbage, or turnips, &c.

SOUP, *Portable*, is a kind of cake, formed of concentrated broth, which, being freed from all fat, and having by long boiling evaporated the most putrescent parts of the meat, is reduced to the consistence of a glue, as in reality it is, and will, like other glues, in a dry place, keep found for years together. Sir John Pringle inclines to believe, that the gelatinous parts of animal substances, such as compose these cakes, are not of a nature much disposed to putrefy. But, however that be, captain Cook observes, that, in his voyage
(see

(see SCURVY), this soup was the means of making his people eat a greater quantity of greens than they would have done otherwise, and so far we must allow it to have been virtually antiseptic. For the method of preparing cakes for portable soup, by Chaptal, &c. see JELLY.

SOUP, in *Agriculture*, a term applied to such liquid animal food or provisions, as are formed by cutting various dry materials, such as hay, straw, &c. and blending them with liquid matters; and also to such as are prepared with meals of different sorts, such as that of oats, peas, beans, and others of a similar kind. By this practice, the substances are not only found to go much farther, but to have a much greater effect in promoting the growth or fattening of the animals.

The advantages of preparing the food, and feeding some sorts of animals in this way, are now well known, as such food not only goes much farther, but affords a much greater improvement in the animals. The advantage of feeding young hogs with soups of these kinds are fast becoming well understood; and the animals are found to go on far better with them than in the old methods of proceeding, but there is still much to be done in regard to the modes of preparing of them, and the conditions in which they should be at the time they are given. See SWINE.

SOUPROSSE, in *Geography*, a town of France, in the department of the Landes; 6 miles S.E. of Tartas.

SOUR. See SUR.

SOUR, a river of France, which rises near Bastogne, in the department of the Forests, and runs into the Moselle, 3 miles above Treves.

SOUR Gullan, a town of Algiers, near mount Jurjura.

SOUR-Dock, in *Botany*. See SORREL.

SOUR-Food, in *Agriculture*, such food as has been rendered sour by the acetous fermentation, and which has lately been said to be of superior utility in the fattening of animals. Oxen as well as swine have lately been supposed by some to feed faster, where their food has been brought into this condition before using it, than when used in the natural state. See STALL-feeding.

SOUR-Gourd, in *Botany*. See ADANSONIA.

SOUR-Grass, in *Agriculture*, the coarse tufty herbage usually met with about the dung-heaps in fields, and where there is much stagnant moisture. It is observed by Dr. Darwin, that where a piece of grass is over-run with tussocks of sour-grass, which often happens near towns, he has been informed, that lime or coal-ashes spread on them, would render the grass sweeter, so that horses or cattle would eat it. But he supposes the more certain and advantageous management would consist in mowing it frequently, and giving it to horses or cattle in the stable or stall; as he believes they will eat it greedily after it has been a few hours withered, and thus the land will not only yield more provender at present, but after a few mowings a sweeter grass will rise in the place of that which was of a bad kind, or of too luxuriant growth, for which purpose it should be mowed as near the ground as may be; or if it be frequently mowed during the summer, and left on the ground, some cattle will eat it, when it is withered to a certain degree; by which the disagreeable flavour of it is probably lessened or destroyed. Proper drainage and close feeding such lands, are likewise useful methods of bringing them into a state of better and sweeter grass.

SOUR-Krout. See CROUTE.

SOUR-Land, in *Agriculture*, a term applied to cold clayey soils, and such as have some sort of impervious strata at no great distance from the surface, by which they are kept in a wet and sour state. See CLAY, and Clayey SOIL.

SOUR-Sop, in *Botany*. See ANNONA.

SOURA, in *Geography*, a town of the Arabian Irak, on the Euphrates; 153 miles N.W. of Bassora.

SOURA, a town of Portugal, in Estremadura, situated on the river Soure; 7 miles S.S.E. of Montemor o Velho.

SOURABAYA, a pleasant town on the N.E. coast of the island of Java, situated on the banks of a river, a mile and a half distant from the sea-shore, so that only the flag-staff can be seen from the road. The river is navigable up to the town for vessels of 100 tons burthen, and the bank on one side is made convenient for tacking. The Chinese carry on a considerable trade here, and have a town on the side of the river opposite to Sourabaya. The country near the town is flat, and the soil light, so that they plough with a single bullock, or buffalo. The latitude in Sourabaya road is $7^{\circ} 11'$ S. The Dutch had a resident in this place, with the rank of senior merchant, and the title of the commander of the eastern district. The chief commodity of this government is rice. The interior parts of the country, near the mountains, are infested with a breed of fierce tigers, which render travelling dangerous. Here is also a breed of horses, small, but handsome and strong. The Javanese in the vicinity are numerous. Stavorinus's Voyage, vol. ii.

SOURAH, a town of Hindoostan, in the circar of Aurungabad; 20 miles S.S.E. of Jaffierabad.

SOURAN, a town of Persia, in Khorassan; 255 miles N. of Herat.

SOURAPATA, a kingdom on the S. coast of the island of Java.

SOURATAU HOUTCHIN, a town of Chinese Tartary, in the country of the Monguls. N. lat. $53^{\circ} 54'$. E. long. $114^{\circ} 34'$.

SOURDEVAL, a town of France, in the department of the Channel, and chief place of a canton, in the district of Mortain; 4 miles N. of Mortain. The place contains 3896, and the canton 9580 inhabitants, on a territory of 115 kilometres, in 9 communes.

SOURDON, in *Natural History*, the name of a bivalve shell-fish found on the coast of Poitou, and other places. It is a small fish, its length being little more than an inch, and its breadth about three quarters of an inch; its shells are both considerably convex; the outer surface is deeply furrowed, but the inside is perfectly smooth: the fish buries itself lightly in the sand, and has a pipe of communication, which it raises to the surface; but as this creature never buries itself deep, the pipe is necessarily very short; but they are cut into several segments at the extremity, and appear as it were fringed, and have several hairs growing from these segments. The sourdon is capable of a progressive motion by means of a limb, somewhat resembling that of the other chamæ, but more than any approaching the nature of a leg, as it in some measure represents, in miniature, a human leg with a clumsy boot upon it: by means of this limb the creature can easily bury itself in the sand, or rise up out of it, or move horizontally on the surface, and that as well backwards as forwards, and with more swiftness than could well be supposed. Mem. Acad. Par. 1710.

SOURE, in *Geography*, a river of Portugal, which runs into the Mondego; 4 miles S. of Montemor o Velho.

SOURERAH, a town of Hindoostan, in the circar of Cicacole; 40 miles W.N.W. of Ganjam.

SOURI, a town of Persia, in the province of Laristan, on the Persian gulf; 38 miles S.W. of Ormus.

SOURING Lime for Mortar and Plaster, in *Rural Economy*, the practice of macerating and rendering it proper

per for these uses. It has been stated by the writer of an "Essay on Quicklime as a Cement," that when lime is to be employed for making plaster, it is of great importance that every particle of the limestone be flaked before it is worked up; for, as the smoothness of the surface is the circumstance most wished for in plaster, if any particles of lime should be beaten up in it, and employed in work before they have had sufficient time to fall, the water will continue to act upon them after the materials have been worked up, will infallibly flake such particles, which will then expand themselves in a forcible manner, and be productive of those excrescences upon the surface of the plaster, which are commonly known by the name of blisters. Consequently, if it be intended to have a perfect kind of plaster, which is capable of remaining smooth on the surface and free from blisters, there is an absolute necessity for allowing the lime of which it is composed, to lie for a considerable length of time in maceration with water, before it is wrought up into plaster, which is a process or operation that is here termed *souring*. Where the limestone is of a pure quality, and has been very perfectly calcined or burnt, there will seldom be any danger of the whole of the lime falling at first; but where it has been less perfectly burnt, there will be many particles, which will require to lie a long time before they will be completely reduced into powder. This macerating process or operation is consequently more necessary with impure than pure lime; but still it ought on no occasion to be omitted or neglected, as there is not the smallest probability, but that some blisters would appear on the surface of plasters made with even the purest lime, when worked up and applied immediately after being flaked, without undergoing this *souring* process in some degree.

The practice is also common of *souring* the lime when it is intended for being used in mortar; but although it is not so indispensably necessary in this case, as in that where it is designed for plaster, yet, when properly performed, it is evident, it is said, that it must even in this instance too be of utility; as any dry knots of lime that may fall after the mortar is used, must have a tendency to disunite the parts of it, which have already been united, and to render the mortar or cement much less perfect than if the whole had been properly mixed up with the materials and allowed to *four* before using. More circumspection is, however, requisite, it is said, in *souring* lime for mortar than for plaster; for, as it is not necessary that plaster should be endowed with a stony degree of hardness, there is no loss sustained by allowing a great proportion of the lime which is designed for that purpose to absorb its air before it be used; for a very small quantity of caustic or quicklime will be sufficient to unite the whole into one slightly coherent mass. Consequently, the only circumstance which is necessary to be attended to in *souring* lime for plaster is, that it be allowed to macerate long enough, as there is no danger of ever erring on the opposite extreme. It is indeed necessary, it is said, on some occasions, it should lie a very long time, before any certainty can be had, that all the particles are thoroughly flaked, as pieces of lime-shells have been known to lie upwards of six months exposed to all the changes of the winter weather, and fall after that period. Such slightly burnt limes are indeed, it is said, usually separated in *sifting* the lime for plaster; but as some small chips may escape, it is always the safest way to allow lime to lie in the *four* a very considerable length of time. Another advantage of some consequence likewise, it is said, attends this practice; as, if by such means a large proportion of the lime be allowed to absorb its air, and become

in the mild or effete state, when it is wrought or beaten up for use, the water can have no sensible effect upon this mild lime; it will only separate the particles of the caustic lime more perfectly from each other, so as to permit it to dry without cracks of any kind, and render the surface of the plaster a great deal more smooth and entire, than could have been the case, if the whole had been made use of while in the perfectly caustic state. By this means too, those crystalline exudations, which are so common on walls newly plastered, will be the best and most effectually prevented. On all which accounts, the practice of *souring* lime, which is designed for plaster, to macerate or *four* a long time with water, should never, it is said, except in cases of necessity, be neglected or overlooked.

However, as lime, from the moment of its being fully flaked, begins to absorb air, and continues to take up more and more every minute from that time until it becomes perfectly mild or effete, so as to be rendered gradually less and less proper for forming mortar of any kind, it necessarily follows, that where lime designed for this purpose is permitted to lie long in the *four*, a great part of it will be converted into chalky matter, or uncrystallized mild or effete lime, in which state it will be capable of having so much sand added to it, or of forming so good a mortar as would have been the case, if a larger proportion of the sandy material had been made use of in the first place, and been wrought up as speedily as possible, without so much *souring*, into mortar, and immediately made use of. The evil will also be increased where the lime has been but slightly burnt, consequently the best burned lime should always be preferred for this use, which, when carefully sifted after flaking, will soon fall sufficiently for this purpose; as the main point here is to have the mortar firm and binding; and the falling or bursting of very small unflaked particles of lime in the mortar afterwards, will not be productive of such evident inconvenience as is the case in the making and using of plaster. In the making of good mortar, it will consequently be necessary to get the best burnt lime, and to only suffer it to macerate or *four* with water a very short time before it is wrought and applied. The best burnt lime, however, mostly requires some days to macerate and *four* with water, before the whole becomes fully flaked and fallen for this use.

This doctrine of the nature and utility of the *souring* process in the making of these substances is supposed to receive additional proof and support from the practice which was followed by the ancients, which is very similar to this, if the accounts given of it by Vitruvius and Pliny can be depended on. The former, it is said, expressly recommends that the lime should be macerated or *soured* in water, for exactly the same reasons that have been already seen, as it is only by that means, he asserts, that the plaster can be prevented from blistering. His words are these: "*tunc de albariis operibus est explicandum. Id autem erit recte, si glebæ calcis optime, ante multo tempore quam fuerit, macerabuntur. Numque cum non penitus macerata, sed recens sumitur—habens latentes crudos cuculos, pustulas omittit.—Qui calculi dissolvunt et dissipant tædiorii positiones.*" Vit. lib. vii. c. 2.

The latter points out, it is said, in a still more clear manner, the difference between the quality of the lime, which is necessary for making mortar and plaster:—a certain proof, it is conceived, that the ancients had been very accurate in the observing of facts, as they could have no idea of the reasoning by which those facts might have been corroborated or explained.

"*Ruinarum urbis,*" says he, "*ea maxime causa, quod*

furto, calcis sine ferrumine suo cementa componuntur. *Intrita* quoque quo *vetustior, eo melior*. In antiquarum (antiquis) ædificiis invenitur, ne recentiore trima uteretur redemptor; idio nulla (nullæ) tectoria eorum rimæ fædaverè." Plin. Hist. lib. xxxvi. c. 23.

In this passage, the writer strongly contrasts, it is said, mortar (*cementa*) with plaster (*intrita*). The first, he contends, by implication, ought always to be composed of lime *cum ferrumine suo*; that is, lime which still retains its *gluten*, cementing or adhering principle; lime that still keeps or possesses that quality, by which it is enabled to unite detached matters into a solid body, and *glue* them, as it were, together. In other places of the same work, the author, it is said, describes it as *calcis quam vehementissimæ*; lime in its most acrid state; that is, perfectly *caustic* lime. And this quality he plainly hints, it gradually loses by time, so as to come at length to be *sine ferrumine suo*: in which state, as it is impossible to become a good firm mortar or cement for building with, those who make use of it as such are severely reprehended. But although the practice of using old and inert lime for mortar is condemned, it is immediately added, as has been seen above, that for plaster it is better than new, because it is not so subject to crack in the work.

Thus it would seem, that the importance of the souring operation or process, for these different purposes, was well known at an early period, though the principles on which its utility depended, were probably far from being understood.

SOURIS, LAKE *des*, in *Geography*, a lake of Canada, the direction across which is amongst islands, N.W. by W. six miles. In this traverse is an island remarkable for a very large stone in the form of a bear, on which the natives have painted the head and snout of that animal; and here they were also formerly accustomed to offer sacrifices. This lake is separated only by a narrow strait from the lake du Serpent, which runs N.N.W. seven miles, to a narrow channel, that connects it with another lake, bearing the same name, and running the same course for 11 miles, when the rapid of the same denomination is entered on the W. side of the lake. A singular circumstance is observable here, that for three or four miles on the N.W. side of this lake, there is an high bank of clay and sand, clothed with cypress trees, no such case occurring on any other lake described by Mackenzie; as they are bounded, particularly on the N., by black and grey rocks. Mackenzie's Travels, Introd.

SOURIS, in the *Manege*, is a cartilage in the nostrils of a horse, by means of which he snorts. See SNORT.

The cutting of this cartilage is called in French *effou-riffer*.

SOURMAN, in *Geography*, a town of Thibet; 250 miles N.E. of Lassa.

SOURNAT, a town of France, in the department of the Correze; 9 miles N.N.W. of Uffel.

SOURNIA, a town of France, in the department of the East Pyrenées, and chief place of a canton, in the district of Prades; 7 miles N. of Prades. The town contains 842, and the canton 3718 inhabitants, on a territory of 160 kilometres, in 12 communes.

SOUROUBEA, in *Botany*. See RUYSCHIA.

SOURTOU, in *Geography*, a town of Chinese Tartary. N. lat. 44° 51'. E. long. 94° 24'.

SOURUNGE, a town of Hindoostan, in the circar of Cicacole; 35 miles S.W. of Ganjam.

SOUSEL, a town of Portugal, in Alentejo, containing about 1300 inhabitants; 6 miles N.N.W. of Eûremoz.

SOUSOU, a town of Asiatic Turkey, in Natolia; 24 miles N. of Satalia.

SOUSOUGHRLIK, a town of Asiatic Turkey, in Natolia; 20 miles S.E. of Balikeftri.

SOUSSERAC, a town of France, in the department of the Lot; 6 miles E. of St. Ceré.

SOUSTONS, a town of France, in the department of the Landes, and chief place of a canton, in the district of Dax. The place contains 2578, and the canton 6604 inhabitants, on a territory of 417½ kilometres, in 11 communes.

SOU-TCHEOU, SOO-CHOO, or SOO-CHOO-FOO, a city of China, of the first rank, in the province of Kiang-nan, situated in the vicinity of Nan-lum, on a river which communicates with the lake Tain-hoo. This is reckoned one of the most agreeable cities in China, and compared by Europeans, who have seen it, with Venice, with this difference, that the latter is built in the sea, and Sou-tcheou is intersected by canals of fresh water, branching from the principal canal, over each of which branches is erected an elegant stone-bridge. In the walls of the city are turned several arches, through which the canal passes. Under these walls are drawn up an immense number of vessels; and one ship-building yard contained, when this city was visited by the embassy, sixteen upon the stocks, close to each other, each of the burden of about two hundred tons. The suburbs are very extensive. Sou-tcheou is large and very populous; the houses are neat and well built, and the inhabitants respectably dressed, mostly in silk. The women, says sir John Staunton, were fairer than those in the north; many of whom wore a small cap of black satin, adorned with spangles upon the forehead, brought down to a peak above the eye-brows; and they had ear-pendants of gold or crystal.

There is not perhaps in the universe, according to Grofier's account, a country more delightful, either for pleasantness of situation, or mildness of climate. The air is so temperate, provisions so plentiful and cheap, the soil so fruitful, and the manners of the people so gentle, that this city is considered as the paradise of China. "Above (say the Chinese authors) is the celestial paradise; but the paradise of this world is Sou-tcheou." Upon observing the continual motion of its immense number of inhabitants, and the confusion occasioned every where by their commercial intercourse with strangers, one would be induced to believe that the trade of all the provinces centered in it. The brocades and embroideries manufactured here are in great request through the whole empire. The jurisdiction extends over only eight cities, one of which is of the second class, and the rest of the third; but all these cities are beautiful, and about two or three leagues each in circumference. In the vicinity of this city is found that remarkable tree which furnishes tallow, the "croton sebiferum" of Linnæus. See CROTON. N. lat. 31° 22'. E. long. 120°.

SOUTELLO, a town of Portugal, in the province of Beira; 17 miles W. of St. Joao do Pefqueira.

SOUT-EL-TELL, a mountain of Algiers; 30 miles N.E. of Tremecen.

SOUTERRAINE, LA, a town of France, in the department of the Creufe, and chief place of a canton, in the district of Gueret; 17 miles W. of Gueret. The place contains 2665, and the canton 10,237 inhabitants, on a territory of 275 kilometres, in 11 communes. N. lat. 46° 15'. E. long. 1° 34'.

SOUTH, one of the four cardinal points of the compass. See CARDINAL Points.

SOUTH, ROBERT, in *Biography*, a divine of the church of England, eminent for learning, talents, and wit, was the son of a London merchant, and was born at Hackney in

1633. He was educated at Westminster school by the celebrated Busby, from whence he was elected to Christchurch, Oxford. Here he was soon distinguished for his classical attainments, of which one of his products was an elegant Latin poem addressed to Oliver Cromwell, on the conclusion of the Dutch war. Another poem of his, which was much read and applauded, was entitled "Musica Incantans," which was afterwards printed separately, at Dr. Fell's request. In 1657 he commenced M.A., and in the following year he received holy orders from one of the deprived bishops, and being soon after chosen to preach the assize sermon before the judges, he made a violent attack upon the Independents, which ingratiated him with the Presbyterians. Soon after the Restoration, he was chosen public orator of the university. In this office he acquitted himself so much to the satisfaction of lord Clarendon, when complimenting him at his investiture as chancellor of the university, that he was taken under the protection of that eminent man, and appointed his domestic chaplain. He was promoted to a prebend of Westminster in 1663, and was in the same year admitted to the degree of D.D. He soon succeeded to a canonry of Christchurch, and in 1673 he attended as chaplain to the younger son of the earl of Clarendon, in an embassy to Poland. On his return he was presented to the rectory of Islip, in Oxfordshire, and became greatly distinguished by his turn for humorous sarcasm, in which he indulged even in the pulpit. During the reign of Charles II. Dr. South was, from principle, a strenuous assertor of the royal prerogative, as he was also during the following reign, though he was fully sensible of the dangers to which the established religion was exposed under the bigotted and gloomy James II. He nevertheless refused to join in an invitation to the prince of Orange to come to its rescue; and after the arrival of that prince, he declined subscription to the association for his support, which was signed by the vice-chancellor, and several heads of colleges in Oxford. When William was seated on the throne, he did not scruple taking the oath of allegiance to the new government, but he is said to have rejected the offer of some persons in power to place him in one of the sees vacated by the nonjuring bishops. His political conduct continued the same; he was a violent enemy to toleration, and to any concessions for conciliating the separatists. In 1693 he engaged in the controversy respecting the doctrine of the Trinity with Dr. Sherlock, and is said to have displayed as great a want of Christian charity, as abundance of learning and orthodox zeal. He now began to decline in health; and though his mind was active, yet his bodily powers failed him, and he passed the greater part of queen Anne's reign in a state of inaction; but on Sacheverel's trial, he exerted himself vigorously to procure a lenient sentence from the judges. When his friends came into power, towards the close of that reign, he was solicited to accept the bishopric of Rochester and deanery of Westminster, but he replied, such a chair would be too uneasy for an old infirm man to sit in. The queen's decease was considered by him as a signal of his own approaching dissolution, "since," he said, "that all that was good and gracious, and the very breath of his nostrils, had made its departure to the regions of bliss and eternal happiness." He died in July 1716, at the age of 83, and was interred with much solemnity in Westminster Abbey.

Dr. South cannot be regarded as a proper pattern of a Christian minister, the follower of the meek and holy Jesus; though his sincerity as a true believer of the doctrines of revealed religion has never been doubted. His temper was harsh and unamiable, irascible and unforgiving, and his talents for wit and humour led him too frequently to in-

dulge in ill-natured sarcasm. His talents were considerable, and he is usually reckoned among the good writers of the time, though he frequently manifested a want of taste in not adapting his wit to subjects suited to it. He is author of Sermons, in six volumes, which have passed through many editions. After his decease there appeared his "Opera Posthuma Latina," and his English posthumous works, which consisted of three additional sermons; Travels into Poland, and Memoirs of his Life, in 2 vols. 8vo. Biog. Brit.

SOUTH, in *Geography*, a short river of Anne Arundel county, in Maryland, which runs easterly into Chesapeake bay; its mouth is about six miles S. of Annapolis city, and is navigable for vessels of burden ten or twelve miles.

SOUTH Anna, a branch of North Anna river, in Virginia, which together form Pamunky river.

SOUTH Bay, a bay in Hudson's Straits, on the N. coast of Labrador, W. of Cape Chidley.—Also, an arm of lake Champlain, extending westerly from its south extremity. Where it unites with the lake, it receives Wood creek from the south.

SOUTH Cape, a cape at the southern extremity of New Holland. S. lat. $43^{\circ} 42'$. E. long. $146^{\circ} 56'$.

SOUTH Creek, a river of North Carolina, which runs into Pamlico Sound, N. lat. $34^{\circ} 54'$. W. long. $76^{\circ} 48'$.

SOUTH Downs, downs of England, in the county of Suffex, between Brighthelmstone and Lewes.

SOUTH Downs Sheep. See SHEEP.

SOUTH-East Bay, in *Geography*, a bay of the S.E. extremity of Tavia-Poenammoo. S. lat. $46^{\circ} 45'$. W. long. $191^{\circ} 21'$.

SOUTH Esk. See ESK.

SOUTH Friar's Bay, a bay on the S. coast of the island of St. Christopher; 3 miles E.S.E. of Basseterre.

SOUTH Hams, a tract of land in the county of Devon, England, in the vicinity of Torbay, celebrated for cyder.

SOUTH Haven Point, a long crooked projection of land on the coast of Dorsetshire, in the English Channel, which forms one of the points of entrance into Pool harbour.

SOUTH Head, a cape on the N.E. coast of New Holland. S. lat. $24^{\circ} 2'$. W. long. $108^{\circ} 17'$.

SOUTH Hero. See HERO. North Hero, in 1810, contained 552, and South Hero 826 inhabitants.

SOUTH Island, a small island in the Indian sea, near the E. coast of Madagascar. S. lat. 17° . E. long. $50^{\circ} 20'$.—

Also, a small island in the strait of Saleyer, near the S. coast of the island of Celebes. S. lat. $5^{\circ} 45'$. E. long. $120^{\circ} 51'$.

—Also, a small island in the East Indian sea, near the S.W. coast of the island of Bouton. S. lat. $5^{\circ} 42'$. E. long. $122^{\circ} 50'$.—Also, a small island in the North Pacific ocean.

N. lat. $24^{\circ} 22'$. E. long. $141^{\circ} 20'$.

SOUTH Key, a small island in the Spanish Main. N. lat. $15^{\circ} 40'$. W. long. $82^{\circ} 35'$.—Also, one of the Bahamas, in the West Indies. N. lat. $22^{\circ} 21'$. W. long. $74^{\circ} 6'$.

SOUTH Mountain. See BLUE Ridge.

SOUTH Point, a cape on the S. coast of the island of Anticosti. N. lat. $49^{\circ} 5'$. W. long. $62^{\circ} 35'$.—Also, a cape at the southern extremity of the island of Barbadoes. N. lat. 13° . W. long. $58^{\circ} 23'$.—Also, a cape on the S.W. coast of Sir Henry Martin's island. S. lat. $8^{\circ} 58'$. E. long. $220^{\circ} 15'$.—Also, a cape on the S.W. coast of the island of Fortaventura. N. lat. $28^{\circ} 1'$. W. long. $14^{\circ} 1'$.

SOUTH River, a river of Antigua, which runs into the sea, a little to the north of Young Point.—Also, a river of Canada, which runs into the St. Lawrence, N. lat. $46^{\circ} 56'$.

W. long. $70^{\circ} 26'$.

SOUTH Salem, a post-township of America, in the State

of New York, and county of West Chester; 50 miles from New York; bounded north by North Salem, east by the state of Connecticut, south by Connecticut and the towns of Pounbridge and Bedford, and west by Somers. The whole of this township may be called a good farming country. In 1810, the number of its inhabitants was 1566. This town was formerly called Salem, but its name was altered in 1808. The inhabitants manufacture most of their clothing in their own houses.

SOUTH Sea. See **PACIFIC Ocean.**

SOUTH-Sea Castle, a fortress of England, in the vicinity of *Portsmouth*; which see.

SOUTH-Sea Company. See **COMPANY** and **FUND.**

SOUTH-Sea Tea, in *Botany*, &c. See **LEX.**

SOUTH Thule, in *Geography*, a point of land in the South Atlantic ocean, being the most southern land discovered by navigators. S. lat. $59^{\circ} 54'$. W. long. $27^{\circ} 45'$.

SOUTH-West Bay, a bay on the south-west coast of Tavai-Poenamoo, between Cape South and Cape West.

SOUTH-West Cape, a cape on the south coast of New Holland, north-west of South Cape. S. lat. $43^{\circ} 37'$. E. long. $146^{\circ} 7'$.

SOUTH-West Point, a cape on the south-west coast of the island of Anticosti. N. lat. $49^{\circ} 25'$. W. long. $63^{\circ} 4'$.

SOUTHADLEY, or **SOUTH HADLEY,** a post-town of America, in the state of Massachusetts, and county of Hampshire, on the east bank of Connecticut river; 12 miles N. of Springfield; incorporated in 1753, and containing 902 inhabitants.

SOUTHAKER LEDGE, a reef of rocks, near the south coast of Labrador. N. lat. $50^{\circ} 5'$. W. long. 60° .

SOUTHAM, a small market-town in Southam division of Knighthow hundred, Warwickshire, England, is situated 10 miles from Warwick, 12 from Coventry, and 82 N.W. from London. In *Domesday* book the name is written *Suchan*, and the town is there said to contain four hides, with two mills, and woods of one mile in length and half a mile in breadth; all which belonged to the king. Henry III. granted it a weekly market, and an annual fair. The market is held on Mondays, but little business is transacted. The chief sources of emolument are the two roads which pass through it: that from Coventry to Banbury, and that from Warwick to London. The parish church is a handsome edifice, with a spire rising from a square tower at the west end. The population of the parish, in the year 1811, was returned as 1007; the number of houses 165.

Two miles from Southam is the village of Long Itchington, where the earl of Leicester magnificently entertained queen Elizabeth, July 9, 1575, in her progress to Kenilworth. The village is now small, but appears to have been of considerable consequence at the time of the Conquest, and for some succeeding ages. It was the birth-place of St. Woltan, bishop of Worcester, in the eleventh century, a man of some eminence in the pious chronicles of that period. *Beauties of England and Wales*, vol. xv. part 2. Warwickshire, by J. N. Brewer.

SOUTH AMBOY, a town of America, in Middlesex county, New Jersey, containing, by the census of 1810, 3071 inhabitants. See **PERTH-Amboy**, which contained 815 inhabitants.

SOUTH AMERICA. See **AMERICA.**

SOUTHAMPTON, or **SOUTHTON,** an ancient borough, port, and corporate town of Hampshire, England, is seated on a neck of land, which is bounded on the west and south by a broad lake-like expanse, called the Southampton Water, and by the river Itchin on the east. From this peculiarity of situation, it has only one approach by

land, from the north; and from the same cause, the first buildings of the town appear to have been raised at the extreme point of land, and to have progressively continued in a line northward, on a ridge of ground between the two waters. Hence the town was soon formed by one long street, flanked and guarded by embattled walls, and strongly fortified gates towards the water on the south, and to the inland country on the north. The present Southampton is comparatively a modern town, and originated in the superior eligibility of its site, for commerce, to the station at Bittern, the Claufentum of the Romans, and the Hamton of the Saxons, &c. The ancient history, before the Norman conquest, applies chiefly to Old-Hampton; but it is almost impossible to ascertain when the old town was deserted, and the new one formed and governed by its own laws. It is evident that Hampton must have been a town of consequence under the Anglo-Saxon dynasty, as it imparted its name to the whole county, and is still the county town.

Historical Events.—The origin and name of this town have occasioned much conjecture and dissertation. The most natural supposition is, that it was derived from the river *Ant*, or *Anton*, near the southern extremity of which it stands. This river, after flowing from the upper parts of the county, and giving appellations to several places in its course, here widens into a considerable estuary; and, in conjunction with the Itchin, forms the head of the Southampton Water, the supposed *Antona* of Tacitus. There are indeed those who prefer deducing it from *Ham*, a home or residence, with the adjunct *Ton*. *Domesday* book and other ancient records, however, clearly favour the former opinion; for in these writings it is spelt *Hantun*, and *Hantune*. The prefix of *South* evidently arose from its relative situation to *Northam*. The county itself was also called *Hantunscyre*, though its name has been long altered into *Hampshire*.

It appears from the Saxon Chronicle, that in 873 Hanton was attacked by the Danes, who landed from 33 ships; but, after committing many atrocities, they were repulsed and driven to their ships. About the year 980 another body of Danes landed here, and ravaged the town and its neighbourhood; and it was scarcely 12 years afterwards, that they are recorded to have a third time plundered Southampton, under the command of Sueno of Denmark, and Olaus of Norway.

It does not appear with any certainty, whether the town had been fortified previous to these devastations; though an eminent antiquary, sir Henry Englefield, suggests the opinion, that a *castle* was built here by the Saxons, very soon after they had achieved a permanent establishment in this country. "The peculiar advantages of the narrow and rather high point of land on which Southampton now stands," says the worthy baronet, "commanding at once the Itchin and Test rivers, and very easily fortified on the land side, could not escape their notice; and from the high circular hill, on which the keep of the castle formerly stood, and the curved line of its yet remaining wall, we have probable grounds for supposing it to be among the most ancient of the Saxon castles."

The different assaults made on Hanton by the Danes, render it probable that it had very early risen to some importance; and most likely from its commerce, to which its situation was very favourable. The accession of Canute to the British sceptre, however, put a period to the Danish ravages in this island; and Southampton appears to have become an occasional residence of that sovereign: for it is here that he is recorded, by Henry of Huntingdon, to have repressed the impious flattery of his courtiers by a most impressive

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pressive lesson. They had hailed him as one whose royal mandate all nature must obey. To put this supposed omnipotence to the test, and to reprove the flattery, he, descending the beach, commanded, says the historian, a chair to be set for him; in which having seated himself, he said to the flowing tide, "Thou art under my dominion, and the ground on which I sit is mine; nor did ever any disobey my commands with impunity: therefore, I command thee not to wet the clothes or feet of me, thy lord and master." But the rude waves, continues the historian, presently came up to his royal feet, and dashed over him; when, springing back, he exclaimed, "Let all the inhabitants of the world know, that the power of monarchs is a vain and empty thing; and that no one deserves the name of king, but He, whose will, by an eternal decree, the heavens, the earth, and the sea, do obey." Nor would he ever after suffer the crown to be put on his head, but caused it to be placed on the great crucifix at Winchester. And it is worthy of remark, that all the coins of Canute seem to give sanction to this story; as they either represent him as wearing a mitre, or a cap, or a triangular covering, similar to that on the coins of St. Edward. See CANUTE.

Several circumstances prove, that this town had attained considerable importance before the Norman invasion; though it appears to have suffered greatly from the ravages of earl Tolstan. Henry I. is supposed to have made it a borough by charter; as the "burgesses of Southampton" are mentioned in his grants to the canons of the priory of St. Dionysius, which he had founded. Many privileges were granted to the burgesses by king John, who exempted them from toll, passage, and portage, by sea and land, in fairs and in markets, throughout all his dominions; as well on this side the sea as beyond. By the same charter he granted them the port of Portsmouth, in *ferm*; for which, together with the *ferm* of Southampton, they were to pay 200*l.* yearly. The agreement to pay this sum sufficiently indicates the opulence and flourishing state of the town at that period; which appears to have arisen principally from the wine trade: and, so early as 1215, the merchants of Southampton are recorded to have imported more wine than any others in England, those of London excepted. White or sweet wines were then mostly in use, and these were chiefly imported from Genoa and Venice, by aliens; who were restricted to this port by a duty payable to Southampton, even if the wine was landed elsewhere.

In the reign of Henry III. the barons of the Cinque Ports became very troublesome to the merchants of Southampton, by frequently attaching their persons, and seizing their goods, under pretended reference to ancient grants. The king, being appealed to on this subject, issued a writ, dated May 14, 1252, commanding the barons to desist from their outrages; and four years afterwards he invested the burgesses with new privileges, by a very ample charter, dated at Bristol, July 14, 1256. It appears that Southampton first sent members to parliament in the 23d of Edward I. Considerable trade was now carried on between this port and France; and the detention, at St. Valery and Barfleur, of some ships belonging to Southampton, was in great measure the cause of the war between this country and France, toward the conclusion of the 13th century.

The trade of this town continued very flourishing till the rupture with France in 1338, on account of the refusal of the states of that kingdom to acknowledge the claims of Edward III. to its throne. The same year the mayor and bailiff were commanded, by writ, to cause all their ships, of 40 tons burthen and upwards, to be victualled, and furnished with men at arms, ready to defend the land, in case

of invasion. These preparations, however, were made too late. The French, with their allies, the Spaniards and Genoese, landed in October, from a fleet of 50 galleys; and, having slain all who opposed them, entered and plundered the town, and afterwards destroyed the greater part of it by fire. Many of the principal inhabitants were, at the same time, inhumanly put to death. The invaders did not, however, effect this devastation with impunity: several distinguished personages of their own party were slain, and, among them, the son of the king of Sicily. This fatal event interrupted the growing prosperity of Southampton; as many of the merchants were totally ruined, and others afterwards removed to places less exposed to invasion. In the following year an act was passed for rebuilding and strongly fortifying the town; and the king, in a new charter, confirmed all the grants made by his predecessors, and invested the inhabitants with additional immunities.

In the reign of Richard II. a plan was proposed, by a rich Genoese merchant, for rendering Southampton one of the principal ports of Europe; but the jealousy of some London merchants is said to have defeated the design, and to have caused the assassination of the projector.

In July, 1345, the army, which afterwards so memorably distinguished itself on Cressy's plains, was embarked at this port. That gallant army of Britons also, which gained immortal fame at the battle of Agincourt, under Henry V., in 1415, was assembled and embarked at Southampton; and it was here that the foul conspiracy against the life of that monarch was timely discovered and punished. The principal conspirators were Richard, earl of Cambridge, grand-father of king Edward IV., lord Scrope of Masham, and sir Thomas Grey of Northumberland. They were brought to trial, condemned, and executed in this town. Lord Scrope, who had been a particular favourite of the king, was hanged, drawn, and quartered: the others were beheaded; and their bodies were interred in the chapel of the *Domus-Dei*, or God's House; as is recorded by an inscription on a stone, erected by a predecessor of the present earl of Delaware. Historians differ widely respecting the motive to this plot. Some say, that the project was suggested by the court of France; which, terrified at the preparations of Henry, had engaged these three noblemen, for the bribe of a million of livres, to murder the king at Southampton; an account which Shakspeare seems to have credited. See his play of Henry V. act ii. sc. 2.

"See you, my princes and my noble peers," &c.

With greater probability, however, others appear to think that the conspiracy was formed originally by the earl of Cambridge, second son of the duke of York; who, having espoused the sister of the earl of March, had zealously embraced the interests of that family, and engaged lord Scrope and sir Thomas Grey to second his views. See Holingshed's Chronicle.

The trade of Southampton must have been in a very flourishing state in the reign of Henry VI.; or we can hardly suppose that so great a man as the lord mayor of London, and keeper of queen Margaret's wardrobe, sir Thomas Cooke, would have borne the office of customer of this port.

In the reign of Edward IV., when the feuds between the houses of York and Lancaster raged with their utmost violence, scarcely a day elapsed which was not marked with some hostilities of the opposite parties. That division of sentiments, with respect to the two contenders for the crown, which pervaded almost all England, subsisted at Southampton; and at last raged with such fury, that a
fierce

fiere skirmish ensued between the partisans of the white and red roses, in which several of the inhabitants lost their lives. The Yorkists being at length victorious, the leaders of the Lancasterian party were made prisoners. Edward was of a temper too jealous and severe to pardon so great an insult on his government. Hastening immediately to Southampton, he commissioned Tiptot, or Tiptoft, earl of Worcester, to fit in judgment on the prisoners. About twenty of them were tried, condemned, and executed; but the malice of the monarch, not satisfied with that infliction, which ought to have closed the scene of human punishment, permitted their breathless carcases to be impaled, and exposed in this horrid state to the public gaze: a mean gratification of impotent revenge, useless as it was unpopular, which brought a deserved odium on the king, and on Tiptot, as the minister of his vengeance. Leland's Collectanea, i. 502.

Among the number of royal visitors who have occasionally honoured Southampton with their presence, it reckons the emperor Charles V., who, in 1522, embarked here on board the English fleet, which conveyed him to Spain. We have also to mention Edward VI. In the year 1552 this prince, having been attacked by both the measles and small-pox, his constitution was so much weakened, as to render relaxation absolutely necessary. By the advice of his physicians, therefore, he made a tour of amusement through the western and southern parts of his kingdom, attended by 320 soldiers, and courtiers and servants to the amount of 4000 horse. Amongst other places, he visited Southampton, and was received by the inhabitants with much respect, and costly preparations. In 1534, Philip, then prince of Spain, but who afterwards reigned as Philip II., landed here, when he came to marry Mary I. queen of England. Queen Elizabeth kept her court here in 1569; and in 1575 granted to the corporation the arms, which are now used in the town-seal.

Camden, who wrote in the reign of queen Elizabeth, says, that the town was, in his time, famous for the number and beauty of its buildings, its affluent inhabitants, and the resort of numerous merchants. But after this, Southampton appears to have declined in its trade and consequence; being, in the year 1695, (as Gibson, in his edition of Camden, observes,) "not in the same flourishing state as formerly: for, having lost its trade, it has lost also most of its inhabitants; and the great houses of its merchants are now dropping to the ground, and only shew its ancient magnificence." Since that time, however, trade has again brought its advantages to Southampton: numerous opulent families also have been attracted, by the beauty of its neighbourhood, to settle in and around it; and it is at present a town of the first beauty and consideration in the west of England.

Commerce and Trade.—Southampton has many considerable wine, corn, and timber merchants. Hemp, iron, and tallow, from Russia, and tar and pitch from Sweden, are imported. English iron is brought coast-ways from Wales; and coals, lead, and glass, are conveyed by the colliers from Newcastle. The importations from Portugal are chiefly wine and fruit. To Jersey and Guernsey 6000 tons of unwrought wool are allowed to be exported annually; great part of which is again returned, manufactured into coarse knit hose. During the last war, large quantities of Spanish wool were landed here. Contracts for biscuits for the navy, and bread and clothing for the army, were executed to a considerable extent. A silk-manufactory employs a number of children. Ship-building is also carried on at different docks near the town. At Woodmill, in the neigh-

bourhood, the late Mr. Walter Taylor's curious machinery for the manufacture of blocks and pumps for shipping still exists; but the chief business of supplying the navy is now transferred to Portsmouth dock-yard. The latest bye-laws for the regulation of the port and harbour of Southampton were arranged in an act of parliament, passed 43d Geo. III.

The corporation, according to its last charter, granted by Charles I., consists of a mayor, a recorder, nine justices, a sheriff, two bailiffs, twenty-four common-councilmen, and as many burgessees. All who have passed the chair are aldermen. The town, which was made a borough by Henry II., and by king John (or, as others say, by Henry VI.) a county in itself, is independent of the lord lieutenant and sheriff of Hampshire. The mayor is admiral of the liberties, from South-sea castle to Hurst castle, and half sea over from Calshot to the Isle of Wight. There are about 700 voters for the two members in parliament for this place; and not only those who pay scot and lot, but out-burgessees also vote. It may be here observed, that several royal burgessees have been enrolled among this corporation: the late prince of Wales, in 1750, at his particular request; the late dukes of York, Cumberland, and Gloucester; his present majesty; the prince regent; the dukes of York, Kent, Cumberland, Sussex, and Cambridge; the duke of Wirtemberg also, who passed through this town immediately after his arrival from the continent.

There are two annual fairs, the principal of which is Trinity fair, held near Chapel Mill, adjoining to the town. It commences on Saturday noon in Whitfun-week, and continues till Wednesday noon in Trinity-week; but Monday is the chief day of business, when there is a tolerable show of cattle. The senior bailiff presides during the fair, having a tent, in which he entertains the corporation, and his other visitants. During the continuance of the fair, no one can be arrested for debt within its precincts. St. Mark's fair is held above Bar, on the 6th and 7th of May. Three weekly markets, on Tuesday, Thursday, and Saturday, are well supplied with excellent fish, poultry, meat, butter, fruit, and vegetables.

The salmon taken in the Southampton Water is excellent, though much less plentiful than formerly; when it is said to have been necessary to stipulate in indentures, that apprentices should not be obliged to eat of this fish oftener than once a day.

Public Buildings, &c.—Of late years Southampton has been much frequented as a watering-place; for which purpose its peculiarly healthful and pleasant situation is extremely favourable. The assembly-rooms are situated near the west quay, and very elegantly fitted up. A theatre was erected here in 1766; but not being found large enough, a new one, on a much more commodious and extensive scale, has since been built on the site of St. John's hospital.

The population of Southampton, as returned under the act of 1801, was 7913, viz. 3390 males, and 4523 females; the number of houses was 1582. But the return of 1811 stated the population at 9617, viz. males 4130, and females 5487; the number of houses 1669.

As already noticed, the northern extremity of the old High-street is terminated by an ancient fortified gate-house, called the Bar-gate. This is a curious structure, and consists of a central arched passage, about eighteen yards in length, and four in width. On both sides of this are two lateral passages, or postern door-ways. This majestic portal was principally built in the reign of Edward III.; and, according to the architecture of that time, it is both machicolated and embattled. On its north front are portrayed two gigantic figures, one on each side of the gate-
way;

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way; which are traditionally said to have been intended to represent, the one, Ascupart, or Ascapard, a terrible giant and mighty warrior; and the other, sir Bevois, or Bevis, of Southampton, who, according to the popular legends, slew him in combat. Over the arches of the gate is the town-hall, which is 52 feet long, and 21 feet wide.

The Castle was situated on the west side of the town, but very little of the ancient building itself is remaining. Its area was of a form approaching to a semicircle, or rather of a horse-shoe; in the southern part of which stood the keep, on a very high artificial mount. This keep was circular, but has given place to a smaller and more modern round tower, erected with the materials of the former one. The view of the town and the adjacent country from this spot is extremely interesting. The castle was purchased by the late marquis of Lansdowne, who made great additions and alterations to it, and fitted it up in a costly, but fantastic style.

There were formerly in Southampton six parish churches: those of Holy-Rood, St. Michael, All-Saints, St. Lawrence, St. John, and St. Mary. But in the reign of Charles II. the parishes of St. John and St. Lawrence were united, and the church of the former was taken down: a burying-ground now occupies the spot on which it stood.

Holy-Rood church has a fine organ, and several handsome monuments; one of which, by Rybrack, to the memory of Miss Stanley, has an inscription from the pen of the author of "The Seasons," Thompson. St. Michael's church is the most ancient in the town, and has a fine slender octangular spire, which greatly adds to the beauty of many prospects: it was erected for a mark or guide to ships entering the port. In the north aisle of the chancel is a handsome monument to the memory of the lord chancellor Wriothesley; and in the opposite aisle, on the south, is a curious antique font. In this church the mayor is always sworn into office. All-Saints church is a modern structure, which does honour to the genius of its architect, the late Mr. Revelly. St. Mary's and St. Lawrence's churches are not particularly remarkable.

A spacious mansion in Porter's-lane, near the site of the Water-gate, displays considerable antiquity. It has been minutely described by sir H. C. Englefield (*Archæologia*, vol. xiv.), in a "Walk through Southampton," who conjectures it to have constituted a part of the palace occasionally inhabited by the Saxon and Danish sovereigns. The length of the building in front is 111 feet.

The *Domus-Dei*, or God's House, is an hospital, founded, according to Leland, in the reign of Henry III., by two merchants, brothers, of the names of Gervasius and Protosius. "These two brethren, as they learned, dwelled in the very place, where the hospital is now, at such time as old Hampton was brent by pyrates; these two brethren, for Goddes sake, caused their house to be turnid into an hospital for poor folkes, and endowed it with some landes." By a charter of 6 Edw. III., however, it seems that Roger Hampton founded it; but at what time is not known. It was given by Edward III. to Queen's college, Oxford, which had been founded by Philippa, his consort; and to that institution it still belongs. The present establishment consists of a warden, four aged men, and as many women, who are allowed two shillings each, weekly, from the college; and have a yearly donation of coals, under the will of the late Mrs. Fifield, of Southampton.

Among other ancient institutions in this town was a house of Grey friars, founded in the year 1240, but of which scarcely any remains are now standing; part of its site being occupied by Gloucester-square; and another

part by a building now used as a warehouse, "for the vast quantities of Spanish wool, which, by *strefs of weather*, are landed here every year." St. John's hospital, for the instruction of six boys in the woollen manufacture, has been lately given to the poor-house by the corporation, with the consent of the heirs of the founder.

A free grammar-school was established in Southampton by Edward VI., in an old building in Winkle-street, now used as a carpet-manufactory; from which, many years afterwards, it was removed to its present situation, an ancient mansion, known by the name of West-Hall. Here are also a charity school, a Sunday school, and a school of industry; and near the entrance of the town, on the right, is a neat range of alms-houses, for eighteen poor widows, who are allowed two shillings each, weekly, from the produce arising from a bequest by Robert Thorner, esq. of Baddesley, who died in July, 1690.

The environs of Southampton are noted for picturesque scenery, handsome villas, and interesting objects of antiquity. About one mile north-east of the town is the site of the ancient *Claufentum*. The situation of this station has been a matter of dispute among antiquaries, nor was it exactly settled till the year 1792, when the Rev. Mr. Warner published an essay to prove it to be at Bittern, and rendered any farther doubt on the subject superfluous: moreover, some late discoveries made there, in the formation of the bridge over the Itchin, and of the road connected with it, have fully confirmed whatever Mr. Warner had previously advanced as conjectural. An account of these discoveries has been published, with an engraved plan of the situation, in the first volume of "The Hampshire Repository." The time when *Claufentum* became a station has also been a subject of dispute; but Mr. Warner pronounces it to have been formed under the direction of Vespasian, during his continuance in the southern parts of Britain.

In 1804 and 1805 other discoveries were made at Bittern, by the late proprietor, Henry Simpson, esq. of which a detailed account has been given by sir H. C. Englefield, bart. in his "Walk through Southampton," 2d edit.

Immediately facing Bittern, on the west side, is Bevis-Hill, so called from a tradition, that sir Bevis, the famous knight of Southampton, lies buried under it. It now makes part of the gardens formed by the late earl of Peterborough, and in which his lordship was used to walk with Arbuthnot and Pope.

About half a mile north of Southampton is Belle-Vue, a handsome building, with highly picturesque pleasure-grounds, belonging to Josiah Jackson, esq. Two miles from this town, towards the north-east, is Portwood House, a mansion of the late Giles Stibbert, esq. who erected it in 1771, from designs by Mr. Crunden, architect. Since then it has been much altered. Seated on an eminence, it commands extensive and diversified views of the Itchin river, Southampton Water and town, and much fine wooded scenery. In the parish of South Stoneham is Wood-Mill, built by the late Walter Taylor, for the manufactory of blocks and pumps for the navy. The improvements made in these articles by Messrs. Taylor and son, have been of great importance in naval tactics. In 1759 these gentlemen exhibited specimens of blocks, shivers, and pins before the Board of Ordnance, who immediately commissioned the inventors to prepare and supply all the gun-tackle blocks for the navy. From this time several improvements were made in the machinery and mechanical formation of blocks, &c. and equal improvements in the construction of ship-pumps. By one of these, called the double bailing machine, four tons of water may be raised in two minutes and a half, and even with or with-

out the atmosphere. (Prints and descriptions of these machines are published in the "Hampshire Repository.") North Stoneham Park, the seat of Mrs. Fleming, is a handsome house, in a fine park, the latter of which was laid out by the late Mr. Brown. In the adjoining church is a superb monument to lord Hawke, who died October 17, 1781. See HAWKE.

The remains of St. Dionysius's priory form a pleasing object from Bittern. They stand at the distance of two miles from Southampton, on the western side of the Itchin, in the grounds which belonged to the late general Stibbert.

At the distance of four miles from Bittern, in a southern direction, are the ruins of Netley, or Letley abbey, on the eastern bank of the Southampton Water. Their situation is very beautiful. The field on which they stand commands several views of the river beneath, equally beautiful, but various according to the spot whence they are seen. The profusion of ivy which covers the mouldering walls; the various shrubs and trees that now occupy the site and walls of the church; the fragments of architecture lying around in disorderly ruin; and the elegance of those few parts which have yet escaped destruction; combine to form a scene which contemplation cannot leave without reluctance. The founder of this abbey, it is believed, was Henry III., who took a certain number of monks from the abbey of Beaulieu, and placed them at Netley, about the year 1229. The monks were of the Cistercian order, and the house itself was dedicated to the Virgin Mary and St. Edward. The site of Netley abbey, with all the buildings, was, at the dissolution, granted by Henry VIII., in the twenty-eighth year of his reign, to sir William Paulet, afterwards marquis of Winchester: they next became the property and residence of the earl of Hertford; and since then were inhabited by the marquis of Huntingdon. The whole is at present the property of lady Holland, widow of the late sir Nathaniel Dance Holland, who has a life-interest in them by virtue of her marriage with her former husband, the late Mr. Dummer, who purchased them of Henry Clift, esq. The principal parts of Netley abbey that remain, are the walls of the church, the kitchen, and the refectory. These are in a state of ruin, but display such elegancies of architecture, as convince us, that the fabric must have been originally of great beauty. On the shore, at a short distance from the abbey, stands a fort, or small castle, called Netley castle, in a dilapidated state, which appears to have been erected by Henry VIII. at the time of his building Cowes and Hurst castles. The passage by water to the Isle of Wight, about fifteen miles distant, is delightfully pleasant.

As natives of Southampton, who have rendered themselves eminent, we cannot omit to mention the names of Nicholas Fuller, a learned divine, born in 1557, who died in 1622-3; Dr. Isaac Watts, born in July 1674, who died in 1748; and Richard Pococke, a distinguished traveller, and bishop of Meath, born in 1704, who died in 1765. See accounts of these under their respective heads.

Southampton lies S.W. from London, at a distance of seventy-four miles, by the way of Basingstoke.

"A Walk through Southampton," by sir Henry Englefield, bart. 8vo. 1805, an interesting and truly rational essay on the antiquities of Southampton and Clausentum. "The Southampton Guide;" "A Companion in a Tour round Southampton," 12mo. 1809; "A Visit to Netley Abbey," 2d edition, all by Mr. John Bullar, a schoolmaster of Southampton, are useful and interesting topographical volumes, and contain much original information. "The Southampton Guide," 18th edition, by T. Skelton, is a well-digested essay on the history, &c. of the town and of

objects in its vicinity. In the Beauties of England, vol. vi. is a copious account of the town and county, by J. Britton and E. W. Brayley.

SOUTHAMPTON, a county of Virginia, between James's river and North Carolina, containing, by the census of 1810, 13,497 inhabitants, of whom 6406 are slaves.

SOUTHAMPTON, a town of Massachusetts, in the county of Hampshire, separated from East Hampton by Pawtucket river; about 9 miles S.W. from Northampton. It was incorporated in 1753, and in 1810 contained 1171 inhabitants.

SOUTHAMPTON, or *South Hampton*, a township of New Hampshire, in Rockingham county, on the south line of the state, which separates it from Massachusetts; 16 miles S.W. of Portsmouth. It was taken from Hampton, incorporated in 1742, and contains 427 inhabitants.

SOUTHAMPTON, a post-township of New York, in Suffolk county, on the S. side of Long island; 100 miles E. of New York; bounded N. by Riverhead and Southold, E. by East Hampton, S. by the Atlantic ocean, and W. by Brookhaven. Its length E. and W. is about 23 miles, and its medial breadth $4\frac{1}{2}$ miles. The soil is light and sandy on the W. and N., but fertile in the S. and E. It is well wooded with pine, oak, walnut, &c. and supplies New York with large quantities of cordwood for fuel. The land requires manure, but with good management yields tolerable crops of grain and grass. Fish is much used for manure. In 1810 this township contained 3899 inhabitants, including 61 slaves, and 475 electors. By means of Sagg-harbour, which is a port of entry in the N.E. corner of this township, it carries on a small trade.

SOUTHAMPTON, a township of Pennsylvania, in Bucks county, containing 739 inhabitants.—Also, a township in Franklin county, containing 1060 inhabitants.—Also, a township in Bedford county, with 932 inhabitants.—Also, a township in Somerset county, having 455 inhabitants.

SOUTHAMPTON, or *South Hampton*, a township in the eastern part of Nova Scotia, in Halifax county, formerly called Tatmagruche; 35 miles from Onslow.

SOUTHAMPTON, or *South Hampton*, a post-town of New York, in Genesee county; 486 miles from Washington.

SOUTHAMPTON Water, or *Triffanton Bay*, a bay of the English Channel, on the coast of Hampshire, extending from about three miles above Southampton to the channel that separates the Isle of Wight from the continent. N. lat. $50^{\circ} 48'$. W. long. $1^{\circ} 7'$. See SOUTHAMPTON.

SOUTH BOSTON, a small town in Virginia, in Halifax county, on the N. side of Dan river.

SOUTH BRANCH HOUSE, a station of the Hudson's Bay Company, in North America, situated on the E. side of Saskatchewan river.

SOUTH BRIMFIELD, a township of the Massachusetts, in Hampshire county; 80 miles W. of Boston; incorporated in 1762, and in 1810 containing 645 inhabitants.

SOUTH BROUGH, a small township in the eastern part of Worcester county, Massachusetts, incorporated in 1727, and in 1810 containing 926 inhabitants; 30 miles W. by S. from Bolton.

SOUTH BRUNSWICK, a township of New Jersey, in Middlesex county, containing 2332 inhabitants.

SOUTHBURY, a town of Connecticut, in New Haven county, containing 1413 inhabitants.

SOUTH CAROLINA. See CAROLINA.

SOUTH EAST, a post-township of New York, in the S.E. corner of Dutchess county; 18 miles E. of West Point; its extent is about six miles square; it is bounded on the S. by West Chester county, E. by Connecticut,

N. by

N. by the town of Patterfon, and W. by the town of Carmel. The face of the country is rocky, mountainous, and hilly, but the foil is in general good, and adapted to grafs. It is well watered, and affords tolerably good crops of grain and fruits. It abounds with iron-ore of good quality. And the river Crotan, which runs through it, affords excellent mill-feats. "Joe's" hill or mountain lies near the centre of this town, and extends to Connecticut. Here are five natural ponds, the largeft, called Peach-pond, being about two miles long and one wide. The population confifts of 1887 perfons, and here is one meeting-houfe. Their domeftic looms produce 21,000 yards of cloth.

SOUTH-END, a hamlet in the parifh of Prittlewell, hundred of Rochford, and county of Effex, England, is fituated on the acclivity of a well-wooded hill, at the mouth of the Thames, nearly oppofite to Sheernefs, forty-two miles eaft from London. Within the laft twenty years this place has obtained fome repute for fea-bathing; and though previously but little known, has been fince advancing to importance. Some refpectable lodging-houfes have been erected for the accommodation of vifitors; and alfo an afsembly-room. At a fmall diftance from the hamlet is a ftone, placed as a boundary mark of the extension of the jurifdiction of the corporation of London over the river Thames, in the eaftern direktion. The village of Prittlewell is built on the declivity of a hill, on the fummit of which is the parifh church, a large and refpectable edifice, the tower of which ferves as a land-mark to veffels failing into the Thames. About a quarter of a mile north of the church was a priory of Cluniac monks, founded in the reign of Henry II. Beauties of England, Effex, vol. iii.

SOUTHERN, THOMAS, in *Biography*, a dramatic writer, is faid to have been born at Stratford-on-Avon, about the year 1662, though others affume that he was a native of Dublin, and educated at the univerfity there till his eighteenth year, when he came to England. He was entered of Pembroke college, Oxford, in 1680, and foon after compofed a tragedy, entitled "The Perfian Prince, or Loyal Brother," which was acted in 1682. He took up his refidence at the Middle Temple in 1683, and in the following year another play compofed by him was acted and published. When James II. came to the crown, he rewarded Southern for his loyalty in defending his caufe, when his exclusion from the throne was warmly, or indeed violently agitated, by giving him a captain's commiffion in the troops intended to oppofe the landing of the prince of Orange. When his military fervices became of no account, he returned to his dramatic career, and wrote feveral pieces, both in tragedy and comedy, from which he drew a liberal fubfiftence. Though Southern does not rank with the higheft of our dramatic geniufes, yet he was capable of deeply interefting the paffions. His belt pieces were "Ifabella," and "Oroonoko;" the latter, formed upon one of Mrs. Benn's novels, was faid to have been taken from a real ftory. Southern was apt to mix fcenes of low and indecent comedy with his tragic fcenes, but they are fo managed that they may be eafily feparated, and leave pieces which are occasionally viewed with applaufe. He lived to a great age, and bore a very refpectable character. He died in 1746, at the age of 84. His plays were published collectively by T. Evans, in 3 vols. 12mo. Biog. Brit.

SOUTHERN Hemisphere. See **HEMISPHERE**.

SOUTHERN Ocean. See **OCEAN**.

SOUTHERN Sign. See **SIGN**.

SOUTHERN States, in *Geography*, a denomination comprehending the following ftates of America; *viz.* Maryland, Virginia, Kentucky, North Carolina, Tenefsee, South Carolina.

rolina, and Georgia, bounded N. by Pennsylvania. The ftates above-mentioned contain, by the cenfus of 1810, 3,246,455 inhabitants, including 1,099,523 flaves. The principal productions of this diftrict of the Union are, tobacco, rice, indigo, wheat, corn, cotton, tar, pitch, turpentine, and lumber; and in this diftrict is fixed the permanent feat of the general government, *viz.* the city of *Washington*, which fee.

SOUTHERNWOOD, in *Botany* and the *Materia Medica*. See **ARTEMISIA**.

SOUTHFIELD, in *Geography*, a township of America, in the ftate of Maffachufetts, and S.E. corner of Berkfhire county; bounded S. by the Connecticut line, containing 147 inhabitants.—Alfo, a township of New York, and the capital of Richmond county, on the S. fide of Staten ifland; 12 miles S. of New York; comprehending an extent along the fea, and at the Narrows, of about eighteen miles in length. The furface is diversified, and the land of various qualities. The fouth part is level, and fit for farming. Here is a tract of natural meadow, around the Great Hills, being a fmall bay, noted for its dams. Here is a very extenfive fhad-fiftery at the Narrows, on the E., within half a mile of which is the plain called "Old Town," which was fortified by the early inhabitants, for defence againft the Indians. The whole population of this town in 1810 was 1007, with 97 electors. The "Narrows, (which fee,) leave an opening for the united waters of the Hudfon and Eaft rivers to communicate with the ocean, 1905 yards wide. On the weft fhore are erected the various military works, defigned for the protection of the trade of New York, and for military defence againft naval foes. Thefe confift of feveral forts and batteries, erected by this ftate fince the year 1807, at a very confiderable expence. Fort Richmond is the principal work, being formed of ftone, and well fupplied with all the apparatus and means of defensive warfare. The telegraph, for speedy communication with New York, ftands on the high grounds in the rear of fort Richmond.

SOUTH GEORGIA. See *NEW GEORGIA*.

SOUTH HEMPSTEAD, a poft-townfhip of New York, in Queen's county, on the S. fide of Long ifland, 22 miles nearly S.E. from New York. It is bounded N. by North Hempstead, E. by Oyster bay, S. by the Atlantic ocean, and W. by Jamaica. This townfhip has the greateft aggregate population of any in the county, and there are feveral fmall villages, the largeft of which is of the fame name with the town. Although it has fome fmall ftreams of water, it principally depends upon tide-mills. The land is generally under good cultivation. The whole population in 1810 was 5804, and at this time it had 445 fenatorial electors. Rockaway beach on the fea-fhore is much frequented in fummer for fea-bathing, and the various pleafures of fifhing, fhooting, &c. Game is very plentiful.

SOUTHILL, a parifh in the hundred of Wixantree and county of Bedford, England, is fituated about four miles diftant from Biggleswade, nine miles from Bedford, and forty-three N. from London. In ancient records it is called South-Yewel. The manor is the property of lord Ongley, who alfo holds the manor of Stamford, or Stamford-bury, in this parifh. The monks of Warden abbey had a manor here in 1369, called Gatelyn's Bury. Sir George Byng, a naval officer of eminance in the reigns of queen Anne and George I., purchafed an eftate and fettled in this parifh. In 1721 he was created a peer, by the title of baron Byng of Southill, and vifcount Torrington. He died in 1733, and lies buried in the parifh church. His unfortunate fon, admiral John Byng, who was fhot by fentence of a court-martial, March 14, 1757, was born and interred

at Southill. He is generally considered to have fallen a victim to the violence of party. There is an inscription in the church to his memory, written, it may be thought, with too much asperity for so sacred a place. There are also several other inscriptions in memory of other branches of the family. The present lord Torrington sold his estate at Southill, in 1795, to Mr. Whitbread, who left it to his son, Samuel Whitbread, esq. M.P. lately deceased. This mansion, which is called Southill-House, ranks among the first in the county. It was built about the year 1795, by Holland the architect. The internal decorations are very elegant. Over the doors of some of the principal rooms are subjects in basso-relievo of animals by Garrard, and paintings of game by Gilpin. In the billiard-room is a collection of Garrard's models of sheep and cattle. Over the book-cases, in the library, are portraits of the principal clerks in Mr. Whitbread's brewery; and over the chimney-piece, that of Mr. Whitbread, sen. placed there by his son, with this modest and appropriate motto, "Nobis hæc otia fecit."

The parish of Southill was inclosed by an act of parliament, passed in 1797, and was then computed to contain 2600 acres. The population return of the year 1811, stated this parish (including the hamlets of Broom and Stamford) to contain 185 houses, and 1024 inhabitants. Lysons's *Magna Britannia*, Bedfordshire, 4to. 1806.

SOUTHOLD, or **SOUTH-HOLD**, a post-township of New York, in Suffolk county, comprising the N.E. part of Long island, bounded N. by Long island Point, southerly by the waters that separate it from the towns of East Hampton and Southampton, and W. by Riverhead. The extent of Southold from W. to E., where it terminates in a point, exclusive of the islands, is twenty-two miles, and its greatest width three miles. In 1810 its population was 2613, including 30 slaves, and it then had 306 electors. Southold town has a street five miles long, in which are the post-office, a meeting-house, and two school-houses, with 160 families; 100 miles E. of New York.

SOUTHOLD, a township of Upper Canada, in Suffolk county, W. of Yarmouth, and bounded on the S. by lake Erie.

SOUTH HUNTINGTON, a township of Pennsylvania, in Westmoreland county, containing, in 1810, 1656 inhabitants.

SOUTHING, in *Navigation*, the difference of latitude a ship makes in sailing to the southward.

SOUTHINGTON, in *Geography*, a township of America, in Connecticut, and county of Hartford; 20 miles S.W. of Hartford, containing 1807 inhabitants.

SOUTH KINGSTON, a township of Rhode island, in Washington county, on the W. side of Narraganset bay, containing 3560 inhabitants.

SOUTH-MOLTON. See **MOLTON**, *South*.

SOUTHWALLS, a town on the S. coast of the island of Pomona. N. lat. 58° 40'. W. long. 3° 3'.

SOUTHWARK, commonly called *The Borough*, a town of Surrey, England, also a suburb of the city of London, and generally regarded as part of that vast metropolis. It is, however, completely separated from London by the river Thames, which at this place is 915 feet across; and over which a bridge was constructed anterior to the Norman conquest. Southwark occupies an area of about one mile and three quarters from east to west, by one mile in an opposite direction. Nearly the whole of this extent is now covered with houses, public edifices, and streets, whilst the bank of the river is occupied by numerous warehouses, manufactories, timber and coal-yards, glass-

houses, &c. The Borough is also noted for its number of hop-warehouses. On the east it is bounded by the parish of Rotherhithe, on the south by that of Newington-Butts, on the west by Lambeth, and on the north by the river Thames. For accounts of each of which, see the respective words.

Ancient History.—Although part of the present district was probably occupied by some Roman villas during the dominion of the Romans in Londinium, yet there is no evidence of its having been a station, or military post. Indeed, it was most probably at that time a marshy tract of land. By the Saxons it was called *Suth*, or "South Work," in reference to some military work or fortification, bearing that aspect from London: it was also called the Borough, or Burg, probably for the same reason. It was anciently a distinct corporation in itself, and was governed by its own bailiffs; but in consideration of the inconveniences arising from the escape of malefactors from the metropolis into this place, it was, in 1327, granted by Edward III. to the corporation of London, on payment of 10*l.* annually. It was then called the *village* of Southwark; it was afterwards styled the *bailiwick* of Southwark, and the mayor and commonalty of London appointed the bailiff. This power, however, not being sufficient to remedy the evil, a more intimate connection was thought necessary; and in the reign of Edward VI. it was united to the city of London, at the earnest and incessant request of the citizens to the lord protector, who was at length prevailed on to grant it; perhaps induced to comply by the consideration of 647*l.* 2*s.* 1*d.* paid for the charter. It was formed into a 26th ward, by the title of "Bridge Ward Without;" and 500 marks more were paid for certain privileges, antecedently enjoyed by the archbishop of Canterbury, the abbot of Bermondsey, the priors of St. Mary Overy's, or Charles Brandon, duke of Suffolk. In consequence of this, it was subjected to the lord mayor of London, who has since appointed the steward and bailiff. Southwark, however, being divided into two parts, this is to be understood only of the division called the *Borough Liberty*, which consists of three of the parishes belonging to the town, with the greater part of a fourth parish. For the city division, the lord mayor, by his steward, holds a court of record every Monday at the sessions-house on St. Margaret's Hill in this borough, for all debts, damages, and trespasses, within the limits of his jurisdiction. To this ward of Bridge Without, which is not represented in the court of common-council, the senior alderman, or father of the city, as he is called, is always removed, as to an honourable sinecure, which exempts him from the fatigues usually incurred in the other twenty-five wards. The other division of Southwark is called *The Clink*, or *The Manor* of Southwark, and is subdivided into the great liberty, the guildhall, and the king's manor; for each of which subdivisions a court-leet is held, where the constables, ale-conners, and flesh-tasters, are chosen, and other business of that kind transacted. This division is in the jurisdiction of the bishop of Winchester, who, besides a court-leet, keeps here a court of record on the bank-side near St. Saviour's church, by his steward, or bailiff, for pleas of debt, for damages, and trespasses. Court-leets are also kept at Lambeth, Bermondsey, and Rotherhithe, three districts adjoining to the Borough.

The first time that Southwark is mentioned in history, is on the occasion of earl Goodwin's sailing up the river to attack the royal navy of fifty ships, lying before the palace of Westminster. This was in 1052; when, we are told, he went *ad Subwecree*, and staid there till the return of the tide.

Although the borough of Southwark has so long been a ward

SOUTHWARK.

ward of the city of London, it still retains the privilege of sending two members to parliament, as it has done ever since the 23d Edward I.; but it is not ascertained when it first sent representatives. The right of election is in the inhabitants paying foot and lot, amounting to about 3200.

The things most worthy of note in the borough-town of Southwark, properly so called, are the churches, the hospitals, and the prisons.

The parishes are St. George the Martyr, St. Olave, (part of this parish is in the city of London,) St. John Horsely-down, St. Saviour, (commonly called St. Mary Overy's,) St. Thomas, and Christchurch: these parishes were found, in 1811, to contain 12,217 houses, and 72,119 inhabitants; viz. 33,611 males, and 38,508 females. The families chiefly employed in agriculture were 116, and those occupied in trades, manufactures, and handicraft, 10,510.

Churches.—The parish church of St. George the Martyr is situated a little to the south of the Marshalsea. The original edifice was of very ancient foundation, and belonged to the abbey of Bermondsey, to which it was given, in 1122, by Thomas Arderne. Being in a very ruinous state, the parishioners obtained an act of parliament for taking down the old church, and erecting another; in consequence of which the present structure was begun in 1734, and finished in 1736. In the old church was interred Edward Coeker, the celebrated arithmetician; and the infamous bishop Bonner, who died miserably in the Marshalsea in 1569, is said to have been buried in the church-yard, under the east window.

St. Olave's church is situated in Tooley-street, near the south end of London-bridge. The original edifice is mentioned as early as 1281, but the date of its erection is unknown. Part of this old church having fallen down in 1736, an act was obtained to rebuild it, and the present structure was finished in 1739.

Eastward of St. Olave's is the parish of St. John Horsely-down, corruptly so called from Horse-down having been originally a grazing-ground for horses. St. John's is one of the fifty new churches ordered by act of parliament to be built in the metropolis, and was finished in 1732, when this district was separated from St. Olave's, and constituted a distinct parish.

St. Saviour's church, commonly called St. Mary Overy, originally belonged to a nunnery founded by a female, prior to the Norman conquest, and endowed by her with the profits of the ferry across the river Thames at this place before the erection of London-bridge. This house was afterwards converted into a college for priests, by whom the first bridge over the Thames was built of wood, and kept in repair, till they were enabled, by the munificence of benefactors, to supply its place by another of stone. In 1106 the college was transformed into a priory of canons regular; but these were scarcely settled, when the bishop of Winchester brought in secular canons in their stead. The revenues of this priory, at its surrender in 1539, were valued at 62*l.* 6*s.* 6*d.* per annum. On its suppression, the inhabitants of Southwark purchased the church belonging to it, which was by charter appropriated to the joint use of the parishioners of St. Mary Magdalen and St. Margaret, by the name of St. Saviour's. This church is built upon the plan of a cathedral, though of smaller dimensions. Part of the original architecture is perceived in the interior, near the west front of the church; as all the rest of the fabric exhibits the styles in use between the 13th and 16th centuries. The tower, standing in the centre, rises in three stories, the walls finishing with battlements, and being adorned at the angles with turrets and pinnacles. It was

from this tower that Hollar took his celebrated views of London, both before and after the great fire in 1666.

This church has three chapels: viz. our Lady's, or the New Chapel, at the east end of which is run out a small monumental chapel, and which, after this edifice became parochial, was let for upwards of 60 years, by the churchwardens, for the purpose of a bake-house; St. John's, now the vestry, on the north side of the choir; and St. Mary Magdalen's, on the south side. In our Lady's chapel is a grave-stone, ten feet in length, on which was formerly a border, and a figure in brass of a bishop in his pontifical habit; it is supposed to cover the remains of the celebrated William of Wykeham, bishop of Lincoln, and afterwards of Winchester, who died in 1395. Eastward of the altar is the monument of Lanelet Andrews, bishop of Winchester, who died in 1626, aged 71. His effigy, in full proportion, habited as a prelate of the order of the Garter, lies on a tomb of black and white marble. At his feet are his arms, within a garter, between two small figures of Justice and Fortitude. Here also is a pleasing mural monument, from a design of Mr. Soane, to the memory of Abraham Newland, esq., late cashier to the bank of England, who was interred here November 28, 1807. In the north aisle is a curious monument, with a statue for Gower, one of the earliest English poets, and a benefactor of this church, to the rebuilding of which he contributed about the year 1400. On the wall are painted three female figures, crowned with dual coronets, representing Pity, Mercy, and Charity. See "The History and Antiquities of the Church and Parish of St. Saviour," by Concanen and Morgan, 1 vol. 8vo. 1795.

St. Thomas's church stands on the south side of St. Thomas's-street. The original church, being old and ruinous, was taken down, and rebuilt in 1702.

The parish of Christchurch was taken out of that of St. Saviour, and was originally part of the district called the liberty of Paris Garden. The first church was erected at the expence of Mr. John Marshall, of Southwark, and finished in 1671; when he endowed it with an estate of 60*l.* per annum, towards the support of the minister. This edifice, however, in consequence of the badness of the foundation, soon became so ruinous, that, in 1737, Mr. Marshall's trustees applied to parliament for power to rebuild it, with the sum of 2500*l.*, which had accumulated in their hands from the trust; and obtained an act for that purpose. The present structure was accordingly erected. It stands on the west side of the road leading from Blackfriars-bridge.

For the hospitals in and near the borough of Southwark, see *St. Thomas's HOSPITAL*, *Guy's HOSPITAL*, and *Magdalen HOSPITAL*.

Here we may mention some other charitable establishments in the vicinity of Southwark. The Asylum is a foundation for preserving friendless and deserted girls under twelve years of age from the danger of seduction and prostitution. This excellent charity was set on foot by the well-known magistrate of Bow-street, sir John Fielding. The first female children were admitted in July, 1758; and they are instructed in such a manner as to render them most useful to society. This building stands at an angle, formed by the meetings of the Westminster-road from the Borough to the Stone's-End, and the direct road to Kensington and Vauxhall.

A little farther on the north side of the Westminster-road is a neat modern edifice, called the Freemasons' Charity-School, appropriated for female children from five to ten years of age; though no child who has not had the small-pox, or who has any defect in her sight or limbs, or is weak

or sickly, can be admitted. Every child applying for admission, must produce a certificate from the master and wardens of the lodge in which her father was made a mason, with a certificate of the marriage of her parents. Sixty girls are maintained and educated in this benevolent institution, which owes its origin to the philanthropic mind of the late chevalier Bartholomew Ruffini, of Pall-Mall.

To the southward of this, and on the site of the Dog and Duck tea-gardens, is a noble edifice, the new Bethlehem hospital, which cost about 150,000*l.* in building. The edifice is large, commodious, and admirably adapted to its destination. It is intended to accommodate 400 patients, and has very recently been completed from the designs of James Lewis, esq., architect. It was commenced in 1812, is about 580 feet in length, and is built chiefly with brick, having stone dressings, a bold portico in the centre, and a dome. About twelve acres of garden ground, &c. attach to this hospital, where some of the patients are allowed to exercise. Among the important improvements and reformations of the present time, is the humane and rational system of managing insane patients, that has been very recently adopted; and in the further improvement of which the English legislature is now engaged. See *Bethlehem HOSPITAL*.

At the point of conflux of the London, Westminster, and Blackfriars-roads, we find an extensive range of buildings for the protection and support of the indigent blind, maintained, like the other institutions that we have mentioned, by voluntary contributions. The unfortunate objects are taught to manufacture baskets, clothes-lines, and fash-cord, which are sold at the school. See *BLINDNESS*.

On the right-hand side of the London-road stands the building belonging to the Philanthropic Society, incorporated in 1806. See *Philanthropic SOCIETY*.

Near Cuper's bridge is established the Refuge for the Destitute. The object of this most benign and excellent charity is to provide a place of refuge for persons discharged from prison, or the hulks, unfortunate and deserted females, and others, who, from loss of character, or extreme indigence, cannot procure an honest maintenance, though willing so to do. They are engaged in useful trades and manufactures suited to their sexes; and as an incitement to good conduct, a certain portion of their earnings is set apart, and allowed them, if discharged with credit to themselves.

Prisons, &c.—At the end of the Borough High-street is St. Margaret's Hill, the site of the ancient church of the same name; which, being forsaken on the union of the parish with St. Saviour's, was converted into a sessions-house and prison, since removed to Mill-lane, and called the Borough compter. The whole has lately been rebuilt, but has nothing worthy of particular notice. In the front, facing Blackman-street, which is a continuation of the High-street, the hutings for the election of representatives for this borough are usually erected. On the opposite side of the street was the Tabard Inn, which was the residence of the abbots of Hyde, in Hampshire, whenever business or their parliamentary duty required their presence in the metropolis. This was the house celebrated by Chaucer as the place of rendezvous for pilgrims repairing to Becket's shrine at Canterbury; and the very building described by him existed till 1676, when it was burnt, with the sessions-house, and other contiguous edifices. When rebuilt, it was ignorantly called The Talbot, under an idea that this was the same with Tabard; and by that appellation it still continues to be known.

On the north side of Tooley-street, next to the Thames, is the Bridge-house, a foundation which seems to be coeval with London-bridge; having been used as a store-house for

stone, timber, and other materials employed in its repairs. It is under the superintendance of two officers, called bridge-masters, who are elected by the livery of London. Below the Bridge-house, on the banks of the Thames, stood the inn of the abbot of Battle. The spot, still called Battle-bridge, was thus named from a bridge over a water-course flowing out of the Thames, built and repaired by this prelate, on whose ground it was situated. In the front of this mansion were the gardens belonging to it; the recollection of whose embellishment is yet perpetuated by the Maze, and the Maze-pond.

On the east side of Blackman-street is the Marshalsea, a court of law and a prison, originally intended for the determination of causes and differences between the king's menial servants, and under the controul of the knight-marshal of the royal household. It had particular cognizance of murders and other offences committed within the king's court. To this place also, persons guilty of piracies and other offences on the high seas are committed, though the offenders are tried at the Old Bailey, in London. The prison, which contains about sixty rooms, is too small, and much out of repair. In 1377 it was broken open by a mob of sailors, and four years afterwards by Wat Tyler's followers. It escaped, however, in the riots of 1780, though the King's Bench, the Borough prison, and the Clink, were all at that time the objects of popular fury. See *COURT of Marshalsea*.

The county-gaol and house of correction is situated in Horsemonger-lane, at the south-east end of Blackman-street. This gaol, which has been recently built, is exclusively for the county of Surrey. It was rendered remarkable in the year 1802, when colonel Edward Marcus Delpard, and six of his associates, were hanged upon a platform on the top of the gaol, being convicted of high treason, upon the evidence of an accomplice. The heads of these wretched persons were severed from their bodies, and held up to the view of the spectators, numbers of whom fainted at the sight.

At the south-west end of Blackman-street is the prison of the King's Bench, a place of confinement for debtors, and for all persons sentenced by that court to suffer imprisonment. It consists of one large pile of brick buildings, comprehending 224 rooms. The south centre has a pediment, under which is a chapel. The place is surrounded by a brick wall about thirty feet high, defended by *chevaux de frise*; without which the marshal, or keeper of the prison, has very handsome apartments. Prisoners in any other gaol may remove here by habeas corpus. The liberties, or *rules*, as they are termed, extend about three miles round the prison; and the right of residing in any part of them may be purchased by debtors at the rate of ten guineas for the first hundred pounds, and about half as much for each succeeding hundred pounds, of the fums for which they are in custody. Day-rules, of which three may be obtained in every term, may be purchased for four shillings and twopence the first day, and three shillings and ten-pence the others. Each person must also give good security to the marshal. The day-rules, however, only authorise the prisoner to go out on the days for which they are bought. The inside of this extensive prison resembles a small town, from the circumstance of its being furnished with butchers' shops, bakers', green-stalls, &c.; while the throng of people constantly at play give it the appearance of a fair. See *COURT of King's Bench*.

The Clink was a gaol at Bankside for the confinement of such as should "brabble, fray, or break the peace on the said bank, or in the brothel-houses." This prison still exists,

SOUTHWARK.

exists, and has been represented as a filthy, noisome dungeon. The bishop of Winchester's steward tries pleas of debt, damages, or trespass within the Clink liberty for any sum.

Palaces, Theatres, &c.—Contiguous to the priory of St. Mary Overy, and nearly at the foot of London-bridge, was situated the bishop of Winchester's palace. The house was built about 1107, by William Gifford, at that time bishop of Winchester, upon a piece of ground belonging to the prior of Bermondsey. Bishop Beaufort, uncle to Henry VI., on being created a cardinal on his return from France, was met by the mayor and aldermen of London, and conducted by them in great pomp to this his palace in Southwark. During the civil wars this place was for some time a prison for the royalists. Sir Francis Doddington and Sir Kenelm Digby were both confined here at once; and here the latter wrote his book on "Bodies, &c." Winchester house was sold by parliament, in 1649, to Thomas Walker of Camberwell, for 43*8*ol. 8*s.* 3*d.* with the park included. The buildings, in the old plans of London, appear to have formed two court-yards, with various offices, &c. The south side was bounded by beautiful gardens, statues, fountains, &c.; the north side by the river; the east by the monastery of St. Saviour; and the west by the Bear-gardens. The greater part of the building, which is still remaining, is occupied by corn-lofts, warehouses, &c.

What is now denominated Bankside, was formerly a range of dwellings, licensed by the bishops of Winchester "for the repair of incontinent men to the like women," and denominated the Bordello, or stew-houses. These brothels were subject to various laws and regulations enacted by parliament; among which we find the following: "that they were to be kept shut on Sundays and holidays; that no married women should be received into them; that no man should be drawn or enticed thither; and that no steward should keep any woman who had on her the venereal disease, then termed the 'perilous infirmity of burnings,' or fell bread, ale, fish, or any victuals." (See BURNING.) In 4 Rich. II. these houses, then belonging to Sir William Walworth, lord mayor of London, were rented of him by froes, or bawds, of Flanders, and were destroyed by the Kentish rebels under Wat Tyler. It seems probable, that resentment for the personal injury sustained on this occasion may have had its share, as well as loyalty, in producing the action for which Walworth is particularly distinguished. The ordinances respecting these houses were, however, again confirmed by Henry VI.; but in 1506 they were for some time uninhabited. It was not long, however, before they were again opened, that is, so many as were permitted; "for whereas," says Fabian, "before were eighteen houses, from thenceforth were appointed to be used but twelve only." These privileged stews had signs painted on the fronts, which looked towards the Thames; as the boar's head, the cross keys, the gun, the cardinal's hat, &c. Stow relates, that the women who frequented them were forbidden the rites of the church, and excluded from Christian burial, unless they were reconciled to it before they died. A plot of ground, called the Single Women's church-yard, at some distance from the parish church, was therefore appointed for their interment. In 1546, these stews were suppressed by Henry VIII.; and it was proclaimed by sound of trumpet, that they should be no longer privileged and used as a common brothel, but that the inhabitants were to keep good and honest rules, as in other places of this realm.

Not far from St. George's church stood the magnificent palace of Charles Brandon, duke of Suffolk, the deserving

favourite of Henry VIII. After his death, in 1545, it devolved to the king, who established here a royal mint. At that time it was called Southwark Place, and in great measure preserved its dignity. Edward VI. once dined in it. His father and successor presented it to Heath, archbishop of York, as an inn or residence for him and his successors whenever they repaired to London. As to the mint, it became a sanctuary for insolvent debtors; and at length, becoming the pest of the neighbourhood, by giving shelter to villains of all sorts, it aroused the attention of parliament; which, by the statutes 8 & 9 Will. III. and 9 & 11 Geo. I. entirely took away its abused privileges.

In the parish of Christchurch, near the water on the Bankside, stood Paris Garden, one of the ancient playhouses of our metropolis. Ben Jonson is reproached by Dekker, an envious critic, with his ill success on the stage; and, in particular, with having performed the part of Zuliman at Paris Garden. It seems to have been much frequented on Sundays. This profanation, however, was at length fully punished by a dire accident which befel the spectators in 1582; when the scaffolding suddenly fell, and multitudes of people were killed or miserably maimed. The omen seems to have been accepted; for in the next century the manor of Paris Garden was erected into a parish, and a church founded under the name of Christ's church.

Near this scene of amusement were the Bear-garden, and a place for baiting of bulls. "Herein (Stow tells us) were kept bears, bulls, and other beasts to be baited, as also mastives in several kennels nourished to bait them. These bears and other beasts are there kept in plots of ground scaffolded about for the beholders to stand safe." This was at that time an amusement for persons of the first rank: our great Elizabeth caused the French ambassadors to be carried to this theatre, to divert them with these bloody spectacles.

Not far from the spot in which the Bear-garden was, near Bankside, is Globe-alley; so called from that theatre which flourished in 1603, with a licence under the privy seal, granted by James I. to Shakspeare, Fletcher, Burbage, Heming, &c. and where the plays of our inimitable Shakspeare were first represented. See PLAYHOUSE.

About ten years after it had been licensed, "by the negligent discharging of a peal of ordnance, close to the south side thereof (says Stow), the thatch took fire, and in a very short space the whole building was quite consumed, and no man hurt, the house being filled with people to behold the play of Henry VIII." In the following spring it was rebuilt; but in the next reign it fell into disrepute. See an interesting account of and disquisition on the Globe theatre and the old playhouses in the Gentleman's Magazine for 1816, and in Malone's and Chalmers's accounts of the English stage, in the third volume of the edition of Shakspeare's Plays, 1813.

St. George's Fields, which have borne their share of celebrity in ancient times, having frequently been the scene of grandeur and cavalcade, and sometimes the rendezvous of rebellion and tumult, and which, less than half a century ago, were mere marshes, and only passable to foot-passengers, are now almost covered with newly-erected buildings, from the ditch at the end of Great Surrey-street, or Burrow's buildings, to the Fishmonger's alms-houses, in one direction; and from the Marshalsea prison to the late Dog and Duck, in the other direction; with several irregular indentations in its circumference. Where the principal roads meet, an Obelisk was erected in 1771, in honour of Brads Cradby, esq. the patriotic lord mayor of London, who had been confined in the Tower, with alderman Oliver, for the conscientious

tious discharge of his magisterial duty. An inscription on one side of it expresses the cause of its erection; and those on the other three sides mark the distances from Fleet-street, London and Westminster bridges. This obelisk is about a mile from the one at the end of Bridge-street, on the city side of Blackfriars-bridge.

One of the new bridges for which acts of parliament have recently been obtained, is designed to cross the Thames from the bottom of Queen-street, Cheapside, to Bankside, and to be called the Southwark bridge: it is also proposed to form a handsome street from the foot of it to St. Margaret's Hill.

In Union-street, northward of the mint, is Union-hall, a handsome structure, appropriated to the purposes of a police office for the Borough.

At the foot of Blackfriars-bridge is a large range of buildings, which were erected by a company of gentlemen some years since, with a view of counteracting the impositions too common in grinding of corn. There was a steam-engine, made by Messrs. Boulton and Watt, of Birmingham, which turned ten pair of stones, each pair grinding nine bushels of corn every hour, without intermission by day or night; besides which, it gave motion to the various apparatus for hoisting and lowering the corn and flour out of and into the barges; for fanning the corn, to keep it free from impurities; and for sifting and dressing the meal from its first state, till perfectly cleared for the use of the baker. The accidental burning of these mills, on the 3d of March 1791, forms a kind of epoch among the remarkable fires that have occurred in and about the metropolis. Such a body of light and heat was scarcely ever known as displayed itself on this occasion. The fire broke out about six in the morning, and burnt with such amazing rapidity, that the house of the superintendent, at one corner of the building, was all that escaped the fury of the flames. Out of 4000 sacks of flour, 36 only were saved. The front, &c. remained some years unrepaired; but the whole range has lately been formed into a row of handsome private houses.

On the opposite side is Albion-place, containing the house belonging to the British plate-glass manufactory. This company, incorporated in 1773, carries on a flourishing concern here, and at their works at Ravenhead, in Lancashire.

On the west side of Blackfriars-road, near the bridge, is the building occupied a few years since by Sir Ashton Lever's museum, removed thither from Leicester-square, when, by lottery, it became the property of Mr. Parkinson. This astonishing collection of subjects of natural history here experienced the most mortifying neglect, till, in 1806, it was finally dispersed by public auction, in a sale which lasted 40 days. The premises are now occupied by the Surrey Institution, one of those useful establishments which are intended to promote the diffusion of science, literature, and the arts, and which was opened March 25, 1808.

Surrey chapel, on the east side of Blackfriars-road, is a large octagonal building, for the use of Protestants of the Methodist persuasion, under the Rev. Mr. Rowland Hill, a rather eccentric preacher, but a most worthy man. It is calculated to hold nearly 5000 persons, and can seldom contain the numbers that flock to it for admittance. The organ, by Elliot, has been much admired for its sweetness of tone, as well as for its extensive powers: it has, in fact, been asserted, that on the performance of one of the hymns descriptive of thunder, many of the congregation have fainted.

The Royal Circus is situated at the end of Blackfriars-road, near the Obelisk, before-mentioned. It originated in

a subscription in favour of Mr. Hughes, a riding-master, who, in conjunction with the late Mr. Dindin, exhibited ballets, pantomimes, and horsemanship, with considerable success. Through some disagreement this house was several years shut up; but was at length opened by Messrs. Jones and Cross. In August 1805, the whole building was consumed by fire, but in the course of the following year it was rebuilt in a manner superior in taste and elegance to the former structure. Under the management of Mr. Elliston, of Drury-lane theatre, the exhibition of horsemanship was abolished; and, with the new appellation of the Surrey theatre, this place has acquired more of the spirit and character of the legitimate drama. Bray's History and Antiquities of Surrey, 3 vols. folio. Description of Surrey in the 14th vol. of the Beauties of England, &c. by F. Schöberl, 1813. Picture of London, 1815. Pennant's Account of London. Oldfield's Representative History of Great Britain, 6 vols. 8vo. 1816. See the article LONDON, in a preceding part of this work; also LAMBETH, SURREY, NEWINGTON-BUTTS, and ROTHERHITHE.

SOUTHWARD, *East*, a township of Pennsylvania, in Philadelphia county; containing 7264 inhabitants.

SOUTHWARD, *West*, a township of Pennsylvania, in Philadelphia; containing 6443 inhabitants.

SOUTH WASHINGTON, a town of North Carolina, on the N.E. branch of Cape Fear river, which is navigable so far for boats; 36 miles from Wilmington.

SOUTHWELL, or SUELL, called *Suthell*, an ancient market-town and parish in the wapentake of Thurgarton, and county of Nottingham, England, is 14 miles N.E. of the county-town, and 138 N.N.W. from London. It is seated on a gentle eminence, on the bank of the river Greet, celebrated for its red trout. Some writers have conjectured it to have been the Ad Pontem of the Romans, but without sufficient grounds of authenticity. There is, however, an ancient trenchment in the vicinity. Its modern appellation is said by Dugdale to owe its origin to a spring or well to the southward of the church. The government of the town is divided between the clergy, called prebends, and laity, or justices: the former exercising authority over one part of the town, called the Prebendage, including the collegiate church and its property; and the latter over the other part, called the Burgage, which comprehends all that part between the market-place and the river. The custodes rotulorum, and the magistrates for this jurisdiction, who are nominated by the archbishop of York, and constituted by a commission under the great seal, hold their sessions both at Southwell and at Scrooby, and perform all other judiciary acts distinct from the county. A collegiate church is said to have been founded here by Paulinus, archbishop of York, about the year 630, and this seems to have been always under the patronage of the prelates of that see, though the first grant we meet with of this is by king Eadwy to archbishop Osefytel, in 958. It appears by Domesday book, that here were several canons at the Conquest, but the number of sixteen was not settled till the next century, and so many continue to this day; for though the then archbishop surrendered this church to king Henry VIII., 1540, yet he established the chapter shortly after, and endowed it with the greatest part of its ancient possessions; and though it suffered again in the time of Edward VI., it was restored by Elizabeth, and confirmed by James I.

The collegiate church is a large, ancient, and very curious edifice. It consists of a nave, with two aisles, two towers at the west end, a transept, a choir with aisles, and a chapter-house. The extreme length from E. to W. is 306 feet, width of transept from N. to S. 121 feet, and breadth of nave

nave 59 feet. The oldest parts, the nave, western towers, and transept, are commonly said to be of Saxon architecture, built during the short reign of Harold; but we should rather refer them to an age after the Norman conquest. The choir, with its splendid stone stalls, as well as the very beautiful chapter-house, are all about the date of Edward III.'s reign. Between the nave and the choir is a stone screen of very elaborate workmanship, with niches, pilasters, pinnacles, crockets, &c. A large alabaster altar-tomb is raised in this church to the memory of archbishop Sandys. In the church-yard was a college for chanting-priests. Here is now a free-school, under the care and government of the chapter, who chooses the master. Two fellowships and two scholarships in St. John's college, Cambridge, are in the presentation of Southwell college. These were founded by Dr. Ketton, canon of Salisbury, in the time of Henry VIII. The archbishops of York formerly had a palace here, situated on the south side of the church-yard, and which was once a large and elegant building: the ruins of it are still extensive, but divested of all its architectural forms. Some windows, and a circular chimney of the age of Henry VIII., yet remain, and being deeply overshadowed with ivy and embosomed in trees, add much to the romantic beauty of the place. The archiepiscopal parks were once four in number; or, according to Leland, three; but they have been divided and enclosed since the destruction of the palace in the civil war of Charles I. During those unhappy times the king was often here; and the town frequently experienced the fate of war. Southwell, according to the population return of 1811, contained 561 houses, occupied by 2674 persons: though not a place of much trade, it has a respectable market on Saturdays, and an annual fair. Dickinson's History and Antiquities of Southwell, 4to. 1787. At the end of Dugdale's History of St. Pauls, is an account of the church of Southwell. Thoroton's History, &c. of Nottinghamshire, by Throsby, in 3 vols. 4to. 1790.

SOUTH WEST POINT, a post-town of Tennessee, at the confluence of the Clinch with Tennessee river, where a block-house is erected; 40 miles from Knoxville.

SOUTHWICK, a township of America, in the state of Massachusetts, and county of Hampshire; 110 miles from Boston: incorporated in 1770, and containing 1229 inhabitants.

SOUTHWIST. See **WIST**.

SOUTHWOLD, a market-town in the hundred of Blything, and county of Suffolk, England, is situated on an eminence overlooking the German ocean, but nearly surrounded by the river Blyth, which here discharges itself into the sea. Its ancient name was Sudwald, or Southwood. It is distant from Ipswich 36 miles N.E., and 105 miles, in the same bearing, from London. The manor was an ancient donation from Alfric, bishop of the East Angles, to the abbey of Bury St. Edmunds, by which it was held for the victualling of the monks. From the dimensions of this manor given in Domesday Survey, Gardner, in his History of Dunwich, calculates that the sea has since gained upon this coast one mile, one furlong, and nineteen perches. In the tenth year of Henry IV. Southwold was exempted from the payment of any customs or tolls, for their small boats, passing in or out of the river or port of Dunwich. Henry VII., in consideration of the industry and good services of the men of Southwold, made the town a free burgh or corporation, to be governed by two bailiffs, a recorder, and twelve aldermen; to whom and the commonalty he gave his lordship, called Queen's demesne revenues, and also the privilege of admiralty, for the annual payment of 14*l*. He further granted them exemption from all dues and customs

payable to Dunwich, and conferred on the town the rights of a haven, which probably caused the denomination of the port of Dunwich to be changed to that of Southwold. Henry VIII. not only confirmed all his father's grants, but added many gifts, franchises, and immunities. These royal favours gave great encouragement to the trade and navigation of the town, of which the fishery constituted a material part, being carried on by merchants, who annually fitted out vessels for taking cod and other fish in the North sea. The herring-fishery off their own coast was highly conducive to the prosperity of the town. Though in some degree affected by the dissolution of religious houses, yet Southwold retained an extensive trade, and surpassed all the neighbouring towns in shipping and commerce. But the greatest calamity that ever befel it was on the 25th of April, 1659, when a fire, heightened by a violent wind, consumed, in the space of a few hours, the town-hall, market-house, prison, granaries, warehouses, and 238 dwelling-houses, and other buildings, with the principal part of the goods and merchandize of the inhabitants; the total loss exceeded 40,000*l*. to the ruin of more than 300 families, so that the town never recovered its former importance. About a century afterwards the commerce was considerably improved: the entrance to the haven being subject to be choaked up, an act of parliament was obtained for repairing and improving it: one pier was erected on the north side of the port in 1749, and another on the south in 1752. The establishment of the Free British Fishery, about the same time, also contributed to the prosperity of the town; two docks were constructed, and various buildings erected for making nets and depositing stores. A chapel appears to have been built here in the reign of king John, by the prior and monks of Thetford, who were patrons of the church of Reydon, to which Southwold was then only a hamlet. This chapel being destroyed by fire about 220 years after its erection, the present edifice was erected about 1460, and was then made parochial, and in 1751 was separated from Reydon, and made a distinct curacy. The length of this fabric is 143 feet; the width 56 feet: it has two aisles, separated from the nave by seven arches, and six pillars of elegant workmanship. The tower, about 100 feet in height, is a fine piece of architecture. Though Southwold has many good houses, it has no other building worthy of particular notice. On the cliffs are two batteries, one of which is a regular fortification, with a parapet and six guns; the other has but two. On a hill called Eye-hill, vestiges are seen of an ancient encampment, which Gardner conjectures to have been a camp of the Danes, when they invaded the country in 1010. The population of Southwold in the year 1811 was returned to parliament as 1369; the houses 326. A respectable market is held on Thursday; and here are two annual fairs.

Southwold-bay, commonly called Sole-bay, is celebrated as the scene of a most obstinate and sanguinary engagement in 1672, between the combined fleets of England and France on one side, and the Dutch on the other. The former, consisting of 101 sail, were lying in this bay on the 28th of May, when the Dutch fleet, composed of 91 men of war, 54 fire-ships, and 23 tenders, commanded by the famous De Ruyter, bore down upon them so unexpectedly, that many of the ships were obliged to cut their cables, that they might get out more expeditiously, and arrange in order of battle. The French bore but a small part in the engagement, which was vehemently contested by the English and Dutch during the whole of the day, till at nine at night, the Dutch vessels being dreadfully shattered, were obliged to retreat, and the English, having equally suffered, were not in a condition to pursue them. In this conflict the Eng-

lish lost six ships, and about 2003 men killed and wounded. The Dutch lost only three ships; their loss in men must have been very great, but the States forbade the publication. *Historical Account of Dunwich, &c.* 4to. 1754. *Beauties of England and Wales*, vol. xiv. Suffolk, by F. Schoberl.

SOUTO MAJOR, a town of Portugal, in the province of Beira; 14 miles N.W. of Pinhel.

SOUTOUX, an Indian village of Louisiana, on the W. side of the Mississippi river, opposite to the Nine-mile Rapids, and 28 above Riviere de la Roche. N. lat. 41° 50'.

SOUTSONE, a town of Little Bucharía; 150 miles W.N.W. of Cashgar.

SOUVERABO, a town of Africa, on the Grain Coast.

SOUVERINHO, a town of Portugal, in the province of Alentejo; 17 miles W.N.W. of O Crato.

SOUVIGNY, a town of France, in the department of the Allier, and chief place of a canton, in the district of Moulins; 6 miles W. of Moulins. The place contains 2659, and the canton 10,022 inhabitants, on a territory of 340 kilometres, in 11 communes.

SOUZA, LOUIS DE, in *Biography*, a Portuguese writer, born at Santarem, was son of a man of rank, governor of the castle of St. George de la Mina. He was educated to the profession of arms, and served first in the order of Malta, when he was taken prisoner by the Turks. After recovering his liberty, he served with the troops in America and the East Indies. After this he married, but the loss of a child and other afflicting circumstances impressed both him and his wife with a spirit of devotion, and they took the religious habit in the Dominican order, De Souza changing his baptismal name of Manuel for that of Louis. He had already acquired a good share of literature, and had written an elegant preface to the Latin poems of Falcone. He was, therefore, chosen to write the history of his order in Portugal in the vernacular tongue, of which he printed the first volume, folio, in 1623. From his papers two other volumes were printed after his death. He was author also of the "Life of Dom. Bartholemew, one of the Martyrs," printed in 1619, and of which a French translation has been given; and "A History of John III. King of Portugal," which has not been published. De Souza is accounted one of the best writers of his country.

SOW, in *Geography*, a river of England, in the county of Stafford, which runs into the Trent, 3 miles E. of Stafford.—Also, a river of England, in the county of Stafford, which runs into the Avon, 4 miles N. of Warwick.

Sow, in *Zoology*. See SUS, HOG, and SWINE.

Sow, in the *Iron-works*, the name of the block or lump of metal they work at once in the iron-furnace. The size of these sows of iron is very different, even from the same workmen and the same furnace. These furnaces having sand-stone for their hearths and sides, up to the height of a yard, and the rest being made of brick, the hearth, by the force of the fire, is continually growing wider; so that if it at first contains as much metal as will make a sow of 6 or 7 cwt., at last it will contain as much as will make a sow of 20 cwt.

Sow, in *Ancient Military Language*, a kind of covered shed, fixed on wheels, under which the besiegers filled up and passed the ditch, sapped or mined the wall, and sometimes worked a kind of ram.

Some say it derived its name from the soldiers lying under it close together, like pigs under a sow; though another reason is given for that appellation, namely, its being applied to digging and rooting up the earth. The former was alluded to by the countess who defended the

cattle of Dunbar against king Edward III., when she threatened, that unless the Englishmen kept their sow better, she would make her cast her pigs. Camden, who mentions this circumstance, says, "the sow is yet used in Ireland." Two machines, the one called the boar and the other the sow, were employed by the parliamentarians in the siege of Corfe-castle, Dorsetshire. The sow was similar in construction to the *Cattus*, (which see), cat-house, or cat, so called because under it soldiers lay in watch, like a cat for its prey; some of these cats had crenelles and chinks, from whence the archers could discharge their arrows; these were called castellated cats.

Sow, or *Hop-sow*, in *Agriculture*, a name applied in some districts, as in the county of Essex, to a tool or contrivance for pulling or forcing up hop-poles out of the earth in which they have been fixed. It is constructed of a stout strong tapering sort of pole or stake, about three inches in diameter, and five feet in length, to which, at the distance of nearly a foot from the lower or larger end, is firmly fixed and clinched a small bar of iron, about half an inch square, and a foot long, which is bent nearly in the middle, so as to form an acute angle with the stake, four inches or rather more being open at the upper end of it, which make a sort of hook with the stake, by which the pole is grasped, and the inside of the iron bar being raised and roughed by the smith, somewhat in the manner of teeth, when fixed upon the lower end of the hop-pole, near the surface of the ground, is enabled to bite and hold it fast; when, by the lower end of the tool being made to rest upon the ground on the opposite side of the hop-pole to that on which the workman stands, and the whole acting as a lever, is readily, and with facility, made to raise or lift the hop-pole out of its socket in the solid ground, though it may be set a foot or more into it.

It is a simple, cheap, and effective invention for accomplishing this necessary purpose in hop-management. In the county of Kent, the implement employed in the same intention is denominated a *hop-dog*; and those in other hop districts have most probably the same name given to them. See HOP.

Sow-Bread, in *Botany*, &c. See CYCLAMEN.

The roots of the round-leaved fow-bread with a purple under-side, have a nauseous, acrid, biting taste: by drying their acrimony is abated; nevertheless, when taken internally, they betray a great degree of irritating power. Dried and powdered they have been given in doses of a drachm, and found to operate as a strong, inflammatory, but slow cathartic. The juice is said to purge when applied externally to the belly in ointment; and the juice or bruised root to be of great efficacy for softening and discussing indolent hard tumours. The flowers are of a different nature, and have not been used medicinally; and the use of the roots is now, among us, in a great measure, laid aside. Lewis.

Sow-Thistle. See SONCHUS.

The common fow-thistle has been much recommended by authors as a refrigerant and attenuant. It was prescribed by many of the old physicians in stranguries, and other disorders of the urinary passages; and ordered externally in cataplasms, in all kinds of inflammations.

Sow-Thistle, Downy. See ANDRYALA.

Sow and Pigs, in *Geography*, rocks in the German sea, near the E. coast of England, and the county of Northumberland; 3 miles E.N.E. of Blythe. N. lat. 55° 9'. W. long. 1° 12'.—Also, rocks on the coast of Massachusetts, in Buzzard's bay, lying off the S.W. end of Catahank island.

SOWAGEPOUR, a town of Hindoostan, in Bahar ; 27 miles N.N.W. of Hajypour.

SOWERBÆA, in *Botany*, was so named, by the writer of the present article, in commemoration of his friend and fellow labourer, Mr. James Sowerby, F.L.S., &c. an excellent botanist and artist, to whose accuracy and acuteness of observation he acknowledges himself to have been often indebted, in the course of his own botanical studies and publications ; and to whom various other authors have been no less obliged.—Sm. Tr. of Linn. Soc. v. 4. 218. Ait. v. 2. 231. Brown Prodr. Nov. Holl. v. 1. 285.—Clafs and order, *Triandria Monogynia*. Nat. Ord. *Spathacea*, Linn. *Asphodeli*, Jull.

Gen. Ch. *Cal.* Common Sheath of several membranous, permanent scales ; the outer ones ovate, concave ; inner in many fine segments. *Cor.* Petals six, ovate, equal, permanent ; three of them interior. *Stam.* Filaments six, short, broad, flattened, obtuse, three of them barren ; anthers three, on the three filaments opposite to the interior petals, oblong, each of two linear spreading lobes, of one cell, slightly connected a little above their base only, divaricated at each end, permanent. *Pist.* German superior, roundish, with three furrows ; style thread-shaped, permanent ; stigma simple. *Peric.* Capsule roundish, three-lobed, of three cells and three valves ; the partitions from the centre of each valve. *Seeds* one or two in each cell, angular, rough.

Eff. Ch. Sheath of many valves. Petals six. Stigma simple. Anthers with divided cells. Three alternate filaments barren. Seeds nearly solitary.

1. *S. juncea*. Rush-leaved Sowerbæa. Sm. Tr. of Linn. Soc. v. 5. 159. t. 6. Ait. n. 1. Br. n. 1. Ker in Curt. Mag. t. 1104. Andr. Repof. t. 81.—Native of Port Jackson, New South Wales. First cultivated by Messrs. Lee and Kennedy, in 1792. It is a hardy greenhouse herbaceous plant, flowering in the early part of summer, and easily increased by parting its fibrous perennial roots in the spring, planting them in peat-earth. The whole herb is smooth, destitute of a stem. *Leaves* numerous, radical, sheathing, erect, linear, acute ; channelled above ; semi-cylindrical beneath ; their sheaths crowned internally with a simple membranous *spicula*, like that of a grass. *Stalk* solitary, erect, simple, above a foot high, taller than the leaves, bearing a rather dense umbel, of copious, elegant, rose-coloured, scentless flowers, much resembling those of several species of *Allium*, on capillary partial stalks, each of which has, as Mr. Brown remarks, a joint under the flower. The capsules become pendulous as they ripen, each enclosed in its shining, scarcely altered, corolla. *Anthers* yellow.

The authority of Mr. Brown, who has examined this plant in its native country, induces us to correct some of our ideas concerning it, which indeed had never been very firmly impressed in our mind. The cells of the anthers prove to be simple, and though they first open at the top, by a seeming pore, they soon split all the way down, by a furrow, which gives them the appearance of being two-celled. Though nearly separate, therefore, through their whole length, these cells together constitute but one anther, as in the *SCITAMINEÆ*, see that article, whose cells are still further disjointed. The genus of *Sowerbæa* is, nevertheless, perfectly distinct, though nearly related to *Allium*. The herb, when bruised, has no peculiar scent.

SOWING, in *Agriculture*, the act of scattering, or putting the seeds of grain, plants, &c. on or into the ground, in order to their producing crops. See *SPREN*.

With regard to the period or season of sowing, or putting crops into the soil, it is remarked, that the most proper and advantageous season for sowing or setting such as possess

the habit, or are capable of perfecting and ripening their seed or produce in the same year, is that of some of the more early spring months, according as they are more forward or late in their kinds, and the climate more mild, or the contrary ; while, on the other hand, such as are, from the peculiarity of their nature or habits, incapable of completing their vegetation in the same year, the most favourable period will be some of the more early autumnal months, according to the differences of their habits, and the variations of climate and season : as by these means, in the former case, the seeds, grains, or roots, become perfectly evolved, and the radicles of the young plants firmly established in the soil, and capable of sustaining themselves against the hot season sets in, which is to bring them to maturity ; and, in the latter, the seeds have attained such a state of growth, and so far fixed their roots in the ground, as to be capable of supporting themselves, without sustaining much injury from the severity of the winter season, and consequently advance with greater rapidity in their vegetation in the spring, in order to perfect their seed by the heat of the summer season.

And it is further stated, on the authority of lord Orford, that the practice is advised of sowing certain sorts of grains and seeds, and also of setting particular kinds of roots, at much earlier periods in the spring than is commonly had recourse to by the farmer. Thus, it is said, by putting barley into the ground in the beginning of February, great advantage has been supposed to have been derived in the forwardness and fineness of the grain. But against this method it has, however, been ingeniously suggested by Dr. Darwin, that as much moisture, with or without subsequent frost, is more liable to destroy the embryo in its very early state in the seed, than after it has shot out roots and a summit, and thus acquired some habits of life, such early sowing must, in some cases, be practised with caution. But that such an objection cannot be brought against the early autumnal sowings.

The crops of autumn-sown wheat should be constantly put into the ground in the latter end of September, or beginning of the following month ; but the former, if possible. And the spring-sown kinds should not be later than the end of March ; as, when later sown, they never ripen well. And with oats and barley crops, February, March, and April, are the seasons usually had recourse to. But from grain seeds and roots requiring such different lengths of time in arriving at maturity, the particular period at which each sort of grain, seed, or root, should be sown, set, or put into the earth, with the greatest chance of success, will be more fully noticed, seen, and pointed out, in speaking of the cultivation and growth of the different sorts of crops.

The last mentioned ingenious writer has likewise remarked, that the difficulty of determining the best season for sowing, or putting in seeds in the spring, owing to the variation of the weather in the same latitude, as well as of laying down or fixing the exact seasons for sowing in different latitudes, occasioned Linnæus to form or construct what he terms a calendar of Flora, which was afterward adapted to this climate by Stillingfleet ; and which consisted in observing the first appearance of the root-scions, or flowers of the uncultivated native vegetables ; with directions to sow the *cerealia*, or harvest-seed, when such plants or flowers became visible. By attention to observations of this kind, on such sorts of uncultivated plants, in many climates, the above writer conceives such tables might be constructed, as would point out the most proper times of sowing the most useful seeds or grains in every latitude and situation.

situation. And he further adds, that another tabular view of the climates where plants grow naturally, and of their native situations, in respect to moisture or dryness, hill or valley, with the kind of soil where they were originally found, might also contribute to their successful cultivation.

The following is the order of leafing of a few trees and shrubs, which Mr. Stillingfleet has put down, as noticed by himself, in the county of Norfolk, in the year 1755.

Plants.	Seasons.
1. Honeyfuckle	January 15
2. Gooseberry	March 11
3. Currant	11
4. Elder	11
5. Birch	April 1
6. Weeping willow	1
7. Raspberry	3
8. Bramble	3
9. Briar	4
10. Plum	6
11. Apricot	6
12. Peach	6
13. Filbert	7
14. Sallow	7
15. Alder	7
16. Sycamore	9
17. Elm	10
18. Quince	10
19. Marsh elder	10
20. Wych elm	12
21. Quicken-tree	13
22. Hornbeam	13
23. Apple-tree	14
24. Abele	16
25. Chestnut	16
26. Willow	17
27. Oak	18
28. Lime	18
29. Maple	19
30. Walnut	21
31. Plane	21
32. Black poplar	21
33. Beech	21
34. Acacia robinia	21
35. Ash	22
36. Caroline poplar	22

Also, the conformity between vegetation and the arrival of certain birds of passage is, he says, extraordinary. Of this he gives an instance, marked down by himself, in the above-mentioned county, in his diary of the same year.

April 16th, young figs appear.

17th, the cuckoo sings.

And he notices, that the word *κοκκυζ* signifies a cuckoo, and likewise a young fig; and that the reason for it is, that in Greece they appeared together. He also states, that the same year he first found the cuckoo-flower to blow the 19th of April. He likewise further adds, that, according to Linnæus, the wood anemone blows from the arrival of the swallow. In his diary for the year 1755, he finds the swallow appeared April the 6th, and the wood anemone was in blow the 10th of the same month. He adds also, that the marsh-marigold blows when the cuckoo sings; and according to his diary, the marsh-marigold was in blow April the 7th, and the same day the cuckoo sung.

It has also been remarked, that a due temperature of the season, with respect to heat or cold, drought or wet, (for all these greatly influence the state of the earth,) is essentially

necessary, and should be carefully attended to by the cultivator, when he sows; but the precise time most proper for this work cannot, by any means, be invariably fixed, because it will always depend on the concurrence of a variety of circumstances. The seasons are more or less forward, and the ground is more or less dry, in some years than in others. A proper series of well-made observations would furnish the best rules in this respect, but certainly would not fix the time of sowing to any particular day or week, for years to come. Linnæus's method, of carefully observing the foliage of trees, &c. would determine the proper time for spring sowing. And Pliny, after mentioning the several constellations by which farmers were guided in his time, instructs the farmer with regard to autumnal sowing, upon a principle similar to that of the great modern naturalist. Why, says he, does the husbandman look up to the stars, of which he is ignorant, whilst every hedge and tree point out the season by the fall of their leaves? This circumstance will indicate the temperature of the air in every climate, and shew whether the season be early or late. This constitutes an universal rule for the whole world; because trees shed their leaves in every country, according to the difference of the seasons. This gives a general signal for sowing; nature declaring that she has then covered the earth against the inclemency of the winter, and enriched it with this manure.

It can, therefore, only be observed in general, that it is better, as has been suggested, to sow early in autumn than too late, provided the season will admit of it; because the plants are better able to resist the severity of the winter, after they have acquired a certain degree of strength; and their roots being then longer, and consequently better fixed in the earth, they will be less liable to be thrown out by the frost. For this reason, in particular, perhaps the colder the climate is, the earlier the wheat should be sown. Some lands are of such a nature, that they swell greatly in hard frosts; and subsiding again upon a thaw, leave the roots of plants quite bare upon their surface. There have indeed been years, in which fields sown very late, for instance in December, have done extremely well; but that ought not, on any account, to be made a rule, experience shewing that such late sowings very seldom answer. On the other hand, the corn is likewise exposed to many dangers, when sown too early; for the stalks, which shoot up before winter, cannot well bear hard frost; though wheat would not be hurt by them, when only in the blade. M. de Chateauxvieux is clearly of opinion, that though the proper time of the year for sowing be come, the corn should not be put into the ground, if the temperature of the season be not favourable; and that, on the contrary, the sowing of it ought to be deferred, in hopes of a change. If, says he, the weather is very hot, and the earth extremely dry, it will be absolutely necessary to wait till some rain has fallen; for otherwise the feed will rise but very imperfectly. This he is sure of, by which he contradicts the common saying of some farmers, that the earth is the best granary to keep the corn in. Full of this notion, whenever the stated times come round, they sow, without distinction, in wet land or in dry. Even heat does not hinder them: they think their feed will certainly sprout well after the first rain; but he has always experienced that the plants have come up thin. But to satisfy himself still farther on this point, he tried an experiment purposely to know whether corn can be sown, with any reasonable expectation of success, when the weather is very hot, and the earth very dry. Upon reading M. Duhamel's Treatise on the Preservation of Corn, he has observed that he had found, by his experiments, that wheat

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dried in a stove, heated to 60 degrees of M. de Reaumur's thermometer, had lost its faculty of growing. From thence he conjectured, that wheat which should undergo a heat, for example, of 30 degrees during a longer time, would be equally parched up, and rendered incapable of vegetating. He considered the earth, when hot and dry, as a kind of stove, in which the seed, if it remain too long without receiving any moisture, may become so dry, that the greatest part of it will never be able to sprout. This reasoning is just, and he therefore determined to have recourse to that trusty guide, experience.

He was sure that the wheat which he sowed was perfectly sound, and in every respect capable of growing. It was, therefore, quite clear, that so great a number of grains out of the whole, which did not sprout at all, lost the faculty of growing, by their being parched up by the heat and dryness of the earth. To be still more certain of this, three weeks after he had sowed these grains, he watered half of them several times, but to no purpose; not one of them rose, and he found several of them quite whole in the earth where he had sown them.

Upon the whole he concludes, from his own repeated practice, that the best time for sowing, in such a climate as Geneva, (which differs very little from our's,) is from the 20th of August to the end of September; and thinks that even the first fortnight in October may be taken in, if the land cannot possibly be sowed sooner. But he allows of this only in a case of necessity, and judges that, rather than sow later, it is best to stay till spring. Thus, says he, it is that experience and observation teach us to leave off bad customs, or such as are not founded on principles with which a man of sense may rest satisfied.

In the northern tracts of the island, where the summer season is not of much length, but stormy and extremely variable in the state of the weather, early sowing is said to have been lately found to be attended with many advantages; and that the prejudices in favour of a late performance of this sort of business is fast wearing off; as the good effects of putting seed into the ground as early as the season will admit, are so evident, in such a climate, and the benefit of the practice so great and manifest, that the most prejudiced are beginning to suspect their late sowings to be bad, and that the practice of those who eagerly catch and embrace the very first opportunities which the state of the weather will allow, of sowing their grain crops, bids the fairest for saving them, at the latter end of the season. The hazard to be dreaded from it with some sorts of grain, as oats, is very little, while the benefit to be derived is very great. The advantages of it are very important, in having the best part of the summer season for bringing the crops to full perfection, which increases the value of the grain, and in having long days and a favourable season for cutting, collecting, and securing the produce in perfect condition: while late sowing, on the contrary, occasions the risk of having the crops exposed, after being cut, for weeks together, in the fields, under rotting rains, until the sheaves become each a mass of vegetation. Instead of fixing upon any exact period for commencing the business of sowing, which is extremely absurd, especially in such a climate, the prudent cultivator will regulate his conduct in this respect by the state of the weather, and the appearances which have been suggested above. And as the gardener forms an annual calendar of the weather for himself, by what he sees coming on in his garden; so should the farmer, by the course of experience and information, learn to distinguish the proper times for performing the particular operations of his art; not, however, by having recourse to any precise

or set period of the season, but by reference to certain natural appearances, which may indicate the mildness or clemency of particular seasons, or the contrary. This may be particularly useful in the business of sowing different kinds of crops.

In many districts towards the southern extremity of the kingdom, the utility and benefits of early sowing have been likewise noticed and experienced, as the earliest sown crops, especially of the wheat kind, have been almost invariably found the best. This opinion, which is of some standing, is, in some measure, confirmed by the assurance, that nearly the whole of the famous crops which have been produced and talked of by the farmers in these districts, were raised from early sowings. Now and then a crop may contradict this conclusion, but they are very rare, and mostly arise from some unobserved circumstance in the land which produced them. There can, therefore, be no reason for doubting that more early sowing than is at present practised, in many cases and circumstances of land, may be highly advantageous and beneficial to the farmer, not only in the quantity of produce, but in several other ways.

It is of the greatest consequence to the farmer, that seed in sowing be placed in the earth at a proper depth, and in the best manner; but experience is yet wanting to determine with due exactness, what is the depth which best suits each kind of grain in different soils. In the spring sowings, when there is mostly much moisture in the soil, from the wetness of the previous seasons, less depth may be required than in the summer, where the land is rendered more dry and parched. From half an inch to an inch and a half, may be fully sufficient for the seeds of the grain, turnip, and carrot kinds, so as that they may be fully protected from birds and insects. And for root-seeds, such as potatoes, from two to four inches, in proportion to the state of the soil, may be quite sufficient.

But, in the very early autumnal sowings, as from the excessive drying heats of the summer season, there must in common be a deficiency of moisture in the earth, it may be better to have the seed put in somewhat deeper, as from two inches to three or more, in order that their vegetation may not only proceed more speedily, but their roots be more fully guarded from the effects of the frosty nights, which usually take place soon after such sowings. And in this way they are more effectually protected from the attacks of birds and other vermin, which are generally more eager and destructive in their attacks, from the diminished quantity of food at such periods of the year.

However, in general, as the process of sprouting or early vegetating is found to be greatly promoted by the seed being fully supplied with oxygen air, it may be the most beneficial practice to have them put into the soil, in rather a superficial manner, or but lightly covered, as by such means they may be the most fully supplied with atmospheric air. And for this reason, too, it may be the most advantageous method to have the seeds or roots deposited in the soil as soon as possible after it has been turned up by the plough or spade, as, in such circumstances, it must contain the largest proportion of atmospheric air among its constituent particles; which, it is observed by Dr. Darwin, may be necessary to stimulate into elevation the plume of the embryo plant, as the moisture of the earth is necessary to stimulate the root into its elongation downwards.

The particular state of the season and climate in which the sowings or plantings are performed, may likewise have some influence on the crops. It has been commonly supposed that the best practice is that of sowing in dry seasons, and setting out plants in such as are moist; but it is obvious,

a late writer thinks, that, in so far as the sowing is concerned, this business ought, in some respect, to be conducted according to the differences of the qualities of the lands and the nature of the climate, in regard to its warmth, or the contrary. Thus, in the drier and more mellow and porous descriptions of soils, and the more warm and genial climates, it may, in many cases, be advantageous, not only to sow in the wet, or rather moist seasons, but also at more early periods, than in such as are more retentive of humidity; as from the moisture being commonly, in such sorts of lands, quickly dissipated, a more certain and expeditious vegetation of the seed may in this way be secured. But in the more heavy and wet kinds of soil, where the climate is colder, it will constantly be a more beneficial method to choose, if possible, a dry and warm season for performing the business of sowing or putting in the crops, as by such means the grain will be more certain of vegetating, and in less danger of perishing by the over-abundant wetness, and the want of heat in such lands and climates. And it has been justly remarked by Dr. Darwin, that in some clayey grounds, much softened by rain, if the seed be put into holes and a dry season succeed, an almost impenetrable crust may be produced by the quick exhalation of the moisture, and what is termed by the farmers, the setting of the clay; and in this manner the vegetation and early growth of the crop be much retarded, or in a great measure prevented. And that though it has been ingeniously suggested that useful purposes in the early vegetation of some sorts of plants may be answered by the sowing of the fruits or husks that surround particular kinds of seeds and berries, no experiments have yet been made to shew whether the sowing the chaff, or covering of the grain with it, might not, in particular circumstances of the soil and climate, be of utility in affording it warmth and protection in the first stages of its growth.

With regard to the methods of sowing or putting the seed into the earth, there are different ones in use, not only in districts where the nature and qualities of the soils are different, but in those in which they have much similarity. It is observed, that the most general and common mode, as well as that which is more or less prevalent in almost every part of the kingdom, is that of sowing or casting the seed over the surface of the ground by means of the hand, having it afterwards covered to a proper depth by harrowing. In this method of performing the business, the most usual practice, especially where the ridges are equal in breadth, and not of too great a width, as five or six yards, is that of dispersing the seed regularly over each land or ridge in once walking round; the seedman, by different casts of the hand, sowing one half going and the other in returning. In doing this, it is the custom of some seedsmen to fill the hand from the basket or hopper which they carry along with them, as they make one step forward, and disperse the seed in the time of performing the next; while others scatter the seed, or make their *casts*, as they are termed by farmers, in advancing each step. Mr. Parkinson states, in the account which he has given of Irish farming, that he found a good sower the most difficult thing to be met with; in fact, he did not himself know the true art of sowing seed broad-cast until he went to America, and the man from whom he took the idea there attracted his notice, from the particular manner in which he walked while sowing, which was precisely as if he had been blind, keeping his eyes on the seed as he threw it, by continually looking upwards. It is consequently evident, that in accomplishing this business with regularity and exactness, upon which much of the success of the crop must depend, there is con-

siderable difficulty, and the proper knowledge and habit of which can only be acquired by experience. Wherever this method of putting in the seed is had recourse to, it is consequently of importance for the farmer either to perform the operation himself, or to be careful in selecting such persons as are conversant with the business, as he may otherwise incur much unnecessary expence in the waste of seed, and run considerable risk in respect to his crop. Mr. Marshall, finding a great waste and inconvenience attending the broad-cast sowing, ordered his seedman to walk on the left-hand inner furrow, with his face towards the land to be sown, and to make his cast diagonally, not across the land. This gave him a great scope; and after a few minutes practice he made very good work: before night he walked at the rate of three or four miles an hour, and though a young seedman, made as good work as could be wished. A man walking in the smooth, open, inner furrow, may sow three acres in less time, with more ease, than one walking among the rough clods and loose mould could sow two acres. This method proved superior to the usual way, being cropped as well, and with less seed. The extra expence of sowing is about two-pence an acre, but the saving of the seed was at least two shillings *per acre*. The method observed was for the seedman to walk up one side of the ridge or bed, and down the other side; always keeping his face, and the hand with which he sows, towards the bed he is sowing. He always keeps his eye on the edge of the opposite interfurrow, and delivers his seed principally on the side of the bed next to it: as he returns, the sides of course are reversed, and the beds become evenly seeded. An old seedman, who has been used to throw large handfuls with all his might, in wide casts straight across his walk, will find it awkward at first to make the snug diagonal cast which is necessary in sowing five-bout beds singly.

But it is observed, that the usual way of sowing in broad-cast cannot answer all the intentions of placing the seed properly in the earth, and must be attended with several inconveniencies: such as the seed's becoming the prey of various birds and animals; its being laid so superficially, that the sun often parches it, or a long continued rain, instead of promoting a kindly vegetation, soaks into the grains, and bursts them; the seed is very unequally sown, because of the inequality of the handfuls which different sowers grasp, and a great part of it necessarily falls together into hollows, where the surface of the ground is any way unequal, &c. And that, sensible of these disadvantages, farmers have, especially for their winter grain, sometimes adopted the method of sowing under-furrow, that is, sowing one half of the seed in broad-cast, and then ploughing it in; and afterwards sowing the other half, which is covered by harrowing. But this method is also liable to almost as many objections as the other; for the quantity sown in each particular spot, and the equal distribution which ought to take place throughout the whole, cannot but be even more uncertain than in the broad-cast, where the whole is sown at once; nor dares the farmer, in this sowing under furrow, omit sowing the second quantity, lest a great part of what has been ploughed down be buried so deep that it cannot rise, especially if the soil is at all strong. And another general fault in the common way of sowing is, that too much seed is employed; partly because custom has established a kind of rule in that respect, and partly on account of the allowances which it is necessary to make for what the birds eat, and for what lies too deep ever to rise; the circumstances by which a very great quantity of corn is absolutely lost. See *BROAD-CAST Sowing*.

There are inconveniencies and difficulties in this manner

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of sowing, on many other accounts; as where the lands or ridges are liable to vary in their dimensions or breadths at the different ends or parts, the sowing is not performed without great trouble and waste of seed, as the scattering of it, in turning so often on the different parts, is prevented from being effected in so regular and exact a manner, as when the seedman is directed by a particular furrow-slice. The sowing is, therefore, sometimes very imperfect in such cases, even with good seedsmen. In sowing in this way there are probably, too, less economy, less exactness in many points, and less attention provided for the management of the crops, while they are growing afterwards.

Sowing in the broad-cast manner has, however, many advocates, and is probably the most prevailing practice in most districts of the kingdom; and some think that, in common, all sorts of grain produce the largest quantity on the acre, when sown in this method. It should, notwithstanding, perhaps give way to the machine practice of sowing, wherever it can be had recourse to with ease and facility.

In general it is, however, supposed, that these inconveniences may be prevented by the drill method of sowing, which drops the seed at whatever depth and distance experience has shewn to be the fittest for the particular kind which is sown; fills all the furrows with earth, so that none of the grain remains uncovered; and lets fall into each furrow the exact quantity of seed which has been found to be most proper. In this way the seed is of course distributed with greater regularity and exactness, both in regard to depth and the distance of the rows, by which the crops not only succeed better, but are more capable of being assisted in their culture afterwards; while much seed is saved. It is likewise believed to have many other advantages over the common method of sowing. See *DRILLING*.

It evidently admits more air and light for the growth and maturation of the crops, and produces a better and more abundant quantity of them. In sowing wheat and other grain crops in this way, they should probably not have more space between the rows than about seven inches; but in other kinds it should vary, according to the nature and habits of the growth of the plants, and the state of the soil. The sowing in this way in too thin a manner has often been injurious to the cultivator.

Sowing is sometimes performed likewise in methods between those of the broad-cast and the drill, as by means of tools with different numbers of shares. The sowing is, in these cases, executed, when the land becomes firm and rather solid, immediately after the tool, over the whole surface of the land in the broad-cast way, the seed molly falling into the little furrows or openings that are left by the implement. In sowing in this manner, there are the advantages, it is observed, of having the land firm between the small drills, of the seed taking firmer hold of the ground, of its being readily performed and attended with little trouble, of the seed coming up with great regularity, of the crop being less liable to accidents, in consequence of the action of the sun and air being more free, of its affording a greater facility in the after-culture, and of the quantity of grain being increased. On light and dry soils, this mode of sowing is said to be attended with the best effects. Some, however, think that one cast before and another after this tool is the most preferable mode of sowing.

But whatever may be the benefits of sowing in the drill manner, it has hitherto made no very great progress, though it is evidently a most useful method.

There are also other methods of sowing, as by dibbling, dropping, and setting with the hand, which, under different

circumstances, are found very beneficial modes. See *DIBBLING* and *RIDGE*.

These are, however, methods which are only suited to particular situations and circumstances of land.

All these different ways of sowing, or putting the seed into the ground, may perhaps be found useful, and be practised with success, under different circumstances and conditions of land; as where one mode is improper, or not capable of being had recourse to, another may be substituted, in order to supply its place, and accomplish this important business of the farmer, in the most proper and desirable manner.

In sowing small seeds for plants, constant attention is necessary to the times or periods at which the plants will be wanted for setting out as crops, and the different sowings made accordingly. For these sowings, small suitable portions of land, in a fine state of preparation and cultivation, and which are well secured, are always to be chosen. The sowings for cabbage, and other similar sorts of plants, should be made at two or three different times, both for the autumn and spring crops, in order that the plants may be strong and healthy. And for raising spring plants of the several different other kinds, as those of the lettuce, or other similar sorts, the seeds should be sown at two or more separate times, in the early spring season, that good plants may be in readiness for setting out, when wanted. In general, small spaces of ground will be sufficient for these purposes, as they may contain the quantities of plants which are necessary. The sowings, in such cases, are to be made in a regular, but not too thick a manner; the plants being afterwards, when of some growth, properly thinned, that they may become strong plants. In sowing some sorts of small seeds, it is useful to mix a little ashes, or some other similar substance, with them, to make them sow better. The sowing of grass-seeds should always be performed in as regular and exact a manner as possible. See *GRASS* and *GRASS-Land*.

SOWING of Seeds, in *Gardening*, the practice of putting seed into the ground, in the garden manner; in which different methods are made use of, according to the sorts: as broad-cast sowing and raking-in, drill sowing, bedding-in sowing, &c.; in each of which there are some advantages in different ways.

The first is the most common and expeditious method of sowing, both for many of the principal crops to remain, and for transplantation; and is performed by sowing the seed with a spreading call evenly all over the surface of the ground, either in one continued plat, or when divided into beds, which is immediately raked with a large rake, to bury all the seeds a due depth in the earth; some requiring to be raked in as light as possible, others half an inch or an inch or more deep, according to their kinds and sizes, &c.

In preparing for this method of sowing, the ground is previously dug over in the common way, or in such a manner as is necessary; making the surface level with the spade, as the work proceeds; and, according to the nature of the seed, sowing it as soon as possible afterwards. And this sort of sowing should generally be performed in dry weather, particularly the early sowings in winter and spring; but in hot weather, in summer and autumn, it may often be eligible to take advantage of sowing immediately after a shower of moderate rain. And as to the sowing the seed in the broad-cast way, it is effected occasionally both with an open and locked hand. In the former case, it is performed by delivering the seeds with an open hand, and broad-spreading call, as practised in sowing corn in the open fields, previously stepping out the ground in breaks, or certain widths,

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as a guide to sow with the greater regularity; proceeding with the sowing along each space with a regular step and cast, giving the hand a proper sweeping cast forward, fully expanded at the delivery of the seeds, making them spread abroad evenly in every part; and thus proceeding up one space, and down another, till finished; which method is practised in large kitchen-grounds, in sowing any considerable space in one continued plat. But the latter is practised occasionally, both in sowing large continued plats of ground, and narrow beds, &c.; but more generally the latter, especially when intended sowing them bed and bed separately; or on narrow borders, and other small plats of ground, commonly sowing or delivering the seeds with a locked or close hand, discharging them from between the fore-finger and thumb; opening or pinching the thumb more or less, according to the size and nature of the seeds, and thickness they require to be sown; giving the hand a sort of jerking turn, or cast forward, at the delivery, to cause the seeds to spread regularly, and in an exact manner.

As soon as the seeds are sown, they should be directly raked in, before the surface of the ground is rendered either too dry by the sun or wind, or made too wet by rain, in a regular and even manner, so as to bury them sufficiently according to their kinds; all large stones, lumpy clods, and rubbish, being cleared off; smaller or larger rakes being used, as they may be necessary. See *Garden-RAKE*.

But previously to the raking in the seeds, sown on the general surface in one continued space, where the ground is loose, light, and dry, and in a dry season, it is sometimes the practice, after sowing, to tread them in evenly by treading the ground all over lightly and regularly with the feet. It is also sometimes proper to pare up the loose earth of the alleys an inch or two deep, and spread it thinly over the surface. The work of treading in the seeds is performed with the feet nearly close together, taking short regular steps, treading the surface all over, once in a place, with but small spaces between the steps.

And in extensive market kitchen-gardens, where large tracts of ground are sown at once, instead of raking in the seed, they, for the sake of expedition and cheapness, have light short-tined harrows to draw with men, with which they harrow in the seeds; and sometimes in light dry ground, and a dry surface, they afterwards roll the ground with a light wooden roller, to close and smooth the surface over the seeds more effectually; performing it when the surface is a little dried, so as not to adhere to the roller.

Also in large garden-farms in fields, where they commonly plough and harrow the ground for the reception of the seeds, they practise only the broad-cast sowing in continued tracts, for almost all their esculent seeds, except pease, beans, and kidney-beans; the ground being prepared by ploughing, and afterwards rough-harrowed, to smooth the surface moderately; the seeds being then sown in the spreading open-handed manner, and harrowed in either with a light short-toothed horse-harrow, or by men for particular crops; when, if very dry weather, they roll the surface afterwards with a wooden roller, drawn by horses, &c. to smooth the surface.

In these sowings, the land may either be formed into small beds of four or five feet in width, sowing each in a separate manner; or the whole may be rendered even, and then sown all over the surface, to be afterwards trodden into beds of suitable breadths, as already suggested. The intervals, in both cases, when the sowing is finished, are to be thinly pared and cast over the beds, which are then raked over in a regular neat manner, the whole length of them. The forming the land into small beds may, in some cases, be the

most desirable and advantageous practice; as where it is wet, and not capable of bearing treading, the intervals can be sown in not only to sow the seed, but perform the raking of it in, without injuring the beds by trampling upon them. Besides, when weeding, watering, or transplanting the crops become necessary, they are capable of being sown in for performing such works, as well as for culling and gathering the produce of them. In kitchen-gardens, however, where there is a scarcity of ground, or where it is of consequence to make the most of every part of such ground, and to use the utmost expedition in sowing or putting in the seed, the whole surface method, in one continued plat, may be the most eligible plan of seeding the land, especially in very large grounds, for the main crops of such kinds, as the carrot, the parsnip, turnip, leeks, onions, spinach, lettuce, radish, and some others.

In the raking or harrowing in the seed, in this mode of sowing, great care is to be taken not to draw the mould and seed into lumps or heaps, but to bury it regularly in the soil, and finish the work in a neat manner. Where the seed has been trodden in, but slight raking is necessary.

This mode of sowing and covering in the seed may be had recourse to for most of the esculent crops, some flower plants, &c.

It may be remarked, that the second method of sowing is necessary for many sorts of seeds, esculent, flower, tree, and shrub kinds in the nursery, both for the plants to remain where sown, and for transplantation; which is performed in drills, from a quarter or half an inch to two or three inches deep, according to the sizes and sorts of seeds; which being sown evenly along the bottom of the drill, the earth is drawn evenly over them with a hoe or rake, the depth as above, and the surface lightly raked smooth. This mode is always proper for large kinds of seeds, such as pease, beans, kidney-beans, and many large kinds of tree and shrub seeds, nuts, and berries; it being not only the most ready method of committing those large seeds to the ground the proper depth, but, by being in rows at a distance, best suits the nature of the growth of these sorts of plants, and their methods of culture. Many kinds of small seeds are also the most conveniently sown and cultivated in drills; such as several of the kitchen-garden plants, as parsley, chervil, coriander, all the sorts of small fallading, and sometimes spinach, beet, &c.; also some of the aromatics, when designed as edgings; and also occasionally in rows in beds, both to remain and for transplanting, such as thyme, savory, hyssop, &c.; likewise many sorts of flower-seeds for transplantation, and sometimes to remain. It is performed by drawing the drills with a common drawing-hoe, larger or smaller, in proportion to the sorts of seeds to be sown; setting a line as a guide to draw the drills straight by, which are drawn of different depths, as the sorts and sizes of the seeds may require, and at proportionable distances, from three or four inches to as many feet, according to the nature of the plants. Sometimes, when very small drills are required for fine or small seeds, to be sown in a bed, border, or hot-bed, it is done with the end of the finger, or with the end of a small flat stick.

The seeds should in general be sown and covered in directly, if the ground be dry and in good order; but if the soil be wet, especially at an early season, it may be proper to suffer the drills to lie or be open and exposed to the sun and air an hour or two, or more, to dry a little, particularly for tender seeds in early sowings, in the full ground. The sowing in the drills is performed for the most part with a locked or closed hand, discharging the seeds from between the fore-finger and thumb, scattering them

them evenly along the bottom of the drill, some forts requiring to be sown thinly just along the middle, such as in the angular drills drawn corner-ways of the hoe, for peas and many other larger feeds; also sometimes for smaller feeds when intended for edgings; but in the shallow flat-bottomed drills, it is generally intended for the feeds to be scattered evenly the whole width of the drill, thicker or thinner, according to the nature of growth of their respective plants.

The work of covering or turning in the earth into the drills over the feeds, may be performed occasionally with the rake, hoe, and feet; but the rake or hoe is the most proper for general practice for all smaller feeds, drawing the earth evenly into the drills a regular depth, fully to the depth of the drill, whether deep or shallow: however, peas, beans, kidney-beans, and such like larger feeds, in large drills at wide distances, are often covered in with the feet, by slipping them lightly along each side of the drill alternately, turning the earth evenly in over the feeds; the surface being then lightly trimmed along with the rake, to smooth it and clear it of large stones, &c.

This is a manner of sowing which has not only the advantage of putting in the feeds to the most equal, regular, and suitable depths, but of placing them in rows at such distances, as may admit the sun, light, and air, in the most effectual manner for promoting the growth of the plants as crops. Besides, the moulding up, and necessary culture afterwards, can be better and more beneficially performed.

In the last method of sowing, the ground being dug and formed into four or five-foot wide beds, with alleys a spade's width or more between bed and bed, and the earth drawn off the top of the bed with a rake or spade half an inch, or an inch, or more deep, into the alley, the seed is sown all over the surface of the bed; which done, the earth in the alley is immediately, either with a rake, drawn spreadingly upon the bed again over the feeds the same depth, or spread over with a spade, and the surface raked smooth and even in a similar manner. It is often practised in the nurseries, especially in sowing some large sorts of feeds, as well as others, but not very frequently in kitchen-gardens. It is not so expeditious as the broad-cast sowing, but is very proper for many sorts of small feeds, and many sorts of the tree and shrub kind, being a very regular method of sowing, so as to cover all the feeds an equal depth, and is performed two or three different ways; such as by the rake, by the spade, and by sifting. It is also sometimes performed with the rake and spade together, particularly when intended to sow any large feeds a good depth, using the rake to shove or rake the earth from off the bed into the alleys; or if it cannot be conveniently performed with the rake a proper depth, it is effected with the spade, trimming or paring the earth evenly off the surface into the alleys; then sowing the feeds all over the surface; and if they are of the larger berry, nut, or stone kind, or any other large feed, previous to covering them, pressing or patting them all evenly down into the earth with the back of the spade; and then, either with the rake or spade, spreading the earth out of the alleys evenly over them; though if it is a deep covering, especially when taken off with the spade, it is most eligible to use the same implement in returning it, being careful to spread it evenly, to cover the feeds all equally a proper depth, smoothing the surface with the rake in finishing the work.

Another method sometimes practised with large feeds is, that when the ground is laid out in beds unraked, the seed is sown on the surface, and with a rake stricken a little into the earth, then with a spade paring the alleys, and casting

the earth evenly over the bed, half an inch, or an inch or more deep, as may be required, raking the surface even. This is also sometimes practised in wetish ground, at an early season, when it does not readily admit of treading or raking. And by deepening the alleys and raking the beds, it drains the moisture from the surface, which is a great advantage in many cases.

The method by sifting is sometimes practised for several small light feeds of a more delicate nature, that require a very light covering of earth when sown; as, in order to cover them as shallow as possible, it is done by sifting fine earth over them out of a wire or chip sieve. Before the seed is sown, the surface of the bed, &c. is raked fine; then the earth thinly shoved off the surface of the bed with the back of the rake into the alley, making the surface as smooth as possible, and then sowing the seed, smoothing it down lightly with the spade, and sifting the earth in the alleys evenly over it to a suitable thickness, as half a quarter or a quarter of an inch deep; or sometimes the surface is only raked as smooth as possible without drawing off the earth, and sometimes only lightly smoothed with the back of the spade, then sowing the seed, and letting some loose fine earth from the alley, or some brought for the purpose, be sifted thinly over it. This, too, is a sort of broad-cast sowing, as the seed is sown over all the surface, but in a somewhat different way to that manner of sowing. But the modes of sowing the different sorts of feed crops are more fully explained under their respective heads.

In the sowing of all kinds of garden feeds, a greater and more exact attention to times and seasons is necessary than in the field, not only for the production of full and good crops of different kinds, but that of having them in due, proper, and regular succession. Small errors, in this respect, are not unfrequently productive of much trouble, inconvenience, and disappointment to the cultivators of such crops, but also to those who make use of them. The neglect of only a few days or a week, in some cases, is even of very material consequence in the raising of crops of this nature.

The larger principal crops are constantly to be sown as near their proper times as possible, and the successional ones in due order after them. Sometimes, however, small crops are sown to come in before the large main ones in particular instances, in which a nice attention to the proper season is requisite.

Small feeds must also be regularly and exactly sown in order to have proper supplies of different sorts of young plants for setting out at proper times and in proper succession.

For flower feeds, exact periods of sowing, according to the nature and habits of the plants, must be likewise chosen in the view of having them in the fullest and best perfection, as well as for proper successions in different cases.

In most cases of garden sowing, it is better to be rather too early than too late, in the different seasons for performing the business.

SOWING-Machine, an agricultural implement, which, as its name imports, is employed for sowing feeds, and distributing them at regular distances upon the land.

The greater number of sowing-machines which are in use, are called *drilling-machines*, because they deposit the feeds in parallel and equidistant rows, or drills extending the whole length of the field. This system of sowing corn, or other feeds, which was invented by Tull, has many advocates, whilst others prefer the ancient mode of broad-cast husbandry, in which the seed is scattered equally over the whole surface of the land. For the comparative advantages

tages of these methods, see the articles DRILL, DRILLING, HOING, HUSBANDRY, and *Drill MACHINE*.

Mr. J. Horn of Dover, Kent, constructed an *universal five-furrow machine* of this nature, which he recommended as suited for either broad-casting or drilling all the different sorts of grain, pulse, and seeds, with equal regularity and ease, as well as in any quantity or proportion, and depth, that may be thought proper. And which also possesses, he says, the peculiar advantage of sowing turnips, so as to ensure the crop against the ravages of the fly. This advantage is obtained by sowing the *usual quantity* of turnip seed *broad-cast* by the machine, and at the same time striking furrows at a proper distance apart in the land; by this means part of the seed is deposited in the drills, and the rest sown in broad-cast between them, so that if it proves a dry season, it is favourable for that deposited in the drills, if a wet season, for that which is sown broad-cast between them: and if that part of the seed which is sown broad-cast is carried away by the fly, that which is deposited in the drills, by coming at another period of time, is saved, and *vice versa*. If the whole grows, the farmer has then the opportunity of selecting the most vigorous plants from both. But notwithstanding these stated advantages, the machine is, we believe, little employed by the cultivators of land.

No machine, as far as we know, has hitherto been invented, which is well contrived for, and adapted to, the purpose of general sowing, though a great number of attempts of this kind have been made at different times, in the view of supplying so great a defect in the agricultural machinery of the country. They have all been found on trial, and when put fully to the test, to be materially defective in some important point or other, which rendered them either wholly useless, or only capable of being employed under particular circumstances. This has been equally the case, whatever may have been the nature or kind of construction, in which they have been formed. In order to construct a machine to be generally useful in this intention, it must be free from every kind of fault or defect in the delivery of all sorts of grain, pulse, and seeds, be capable of very great nicety and variation in sowing all these different articles, be very easy and exact in the movements of the internal parts, have great latitude of motion, giving way, and taking up in the shares or other parts, which are made use of in forming the little furrows or drills in the land, be capable of being guided and directed with ease and facility in a regular, steady, and exact manner, be cheap and reasonable in the expence of its construction, &c. But very few of these materially important points and objects have yet been accomplished in a full, complete, and satisfactory manner, in any of the sowing machines which have been contrived and constructed. Some of them, as already suggested, have a defect in some one of the particulars, some others in another, by which means they become neglected and of no use to the farmer, whose sowing must at least be performed with a certain degree of correctness.

It is evident, therefore, from what has been said, that the constructors of such sorts of machinery, to render it generally useful, should have a full and competent knowledge of the most proper proportions or quantities of the above several kinds of articles which are to be sown, as well as of the most suitable widths, distances, or spaces between the rows, which are necessary to be sown and left, in different cases and circumstances, in sowing with machines of this nature, as where this is not the case, there must frequently, if not generally, be much loss sustained in making such machines to sow too much or too little seed, as the dif-

ferences in the seed, and the spaces which are required in different states and circumstances, and conditions of land and season, are very great. The proportions of seed that are the most beneficial for early and late sowing are by no means the same; nor does different kinds and states of the soil admit of the same. They may differ also on some other accounts. The spaces, which are the most useful, likewise vary greatly in different kinds of soil, crops, and cultivation. It is consequently seen, that a perfect knowledge of this sort is absolutely necessary, and that such sowing machines as are incapable of sowing any kind of grain or seed in any proportion or quantity which may be required, are by no means fit for public or general use. In the internal parts of machines of this sort there should be great simplicity and incapability of being put out of order, the moving cylinders, or other parts supplying their places, being made so as to admit of great variation in the degrees of their motion or velocity. The utility of tin cylinders for this purpose is somewhat doubtful, and the shaking or sifting principle has not been found to succeed well, except in the case of round seeds, such for instance as those of the turnip, cabbage, rape, clover, and some other similar kinds, and even in these cases sometimes, with some of these seeds, a seed will stick in a hole which will permit another sort to pass in a free manner, and in those sorts which most readily pass, there is rarely a deficiency of some small seeds, of which two are capable of entering the same hole at the same time, which, by sticking fast together, impede and prevent the delivery in such machines. On this account, some sowing machines sow too much of one sort of such seeds and scarcely half enough of another. Pierced cylinders of the tin kind might probably be made to sow peas, which are nearly round in their form; but they would not be found to answer the same purpose for wheat or beans, and still less for barley or oats. And the same may perhaps be the case in sowing some other sorts. It is therefore probable, that wooden or metal cylinders, which have grooves on their surfaces, and brushes to promote and regulate the delivery, are the best modes which have yet been discovered for effecting the purpose of sowing in a proper manner in these machines, though they are far from approaching any sort of perfection in the business.

The shares, or other contrivances, which are made for the purpose of forming the little drills or furrows in the ground for the reception of the seed, should have great power and facility of moving and giving way in an upward direction in case of their meeting with any hard impeding substances in the soil, and that they may be used on all sorts and forms of ridges. They should also have the capability of being wholly taken up, when occasion may require, as in turning at the ends of the ridges, and in removing from one place or field to another, in order to prevent the machine from being broken and destroyed.

These machines should likewise have great ease and capability given them of being directed and guided, while in their work, by the exact regulation of the share or sowing parts only, or by these in connection with the other parts, as where there is a want or any material incorrectness in this respect, the after-culture of the crops may be greatly impeded or wholly hindered from taking place.

There is, consequently, a variety of points and circumstances which should engage the attention and consideration of the agricultural artificer and mechanic, who is anxious to succeed in the construction of useful machinery of this sort, and particularly that of a general or universal sowing-machine.

The article *Drill MACHINE* contains an account of sowing

ing-machines that are intended to sow the seeds in drills, and a minute description of one invented by Mr. Salmon, which is very superior to the others, as it is capable of being guided, and thus laying the drills in exact straight lines, a circumstance of the first importance in the operation of drilling, that the horse-hoe, which is to pass in the spaces between the drills, may not cut the young plants.

The term *sowing-machine* is almost exclusively confined to some implements lately introduced for sowing seeds in the broad-cast manner, that is, for distributing them equally over the whole surface; and this operation can be much better performed by the aid of a machine, than by scattering it abroad by hand, as in the ordinary method. The most approved sowing-machine is that of Mr. Bennet's, which is extremely simple: a slight wooden box, or trough, of a triangular figure, about five inches each side, and five or six feet in length, is held horizontally by the sower, who carries it suspended by a belt round his neck, so that the length of the trough is before his breast crosswise. The trough is filled with the seed which is to be sown or distributed; and at the bottom angle of the trough is a slight wooden axle, extending the whole length of it. This axle is turned round by an endless band and a wheel, which is mounted in a frame upon the top of the trough, and furnished with a small handle, conveniently situated for the sower to turn it round, and thus give motion to it. The axle has several notches, or small cups, cut in it at various places, and the bottom angle of the trough is open all the length; but the axle lying immediately beneath, closes the opening, and by hair-brushes is made so close, that no seed can pass, except when the axle is caused to revolve; the cups or notches then become filled with the seed, which is contained in the bottom of the trough, and they carry down their contents of seed through the bottom of the box, and it drops on the ground in a slight shower before the sower. The cups or notches are so arranged at intervals round the axle, that they will distribute the seed in the most equal manner possible, upon the whole breadth of ground over which the trough moves, when it is carried forwards as the sower walks in a straight line from one side of the field to the other; but the regular distribution of the seed, in the direction lengthwise of his walk, will altogether depend upon the precision with which he turns the handle of the wheel with a regular motion. As this is rather difficult to effect, Mr. Bennet has made another machine, which runs upon a wheel, like a wheel-barrow; and the motion of this wheel is communicated by wheel-work to the central axle, so that it turns regularly, and distributes the seed always in a given proportion to the distance of land over which it travels. The trough of this latter machine is the same as the former; and the axle, with the notches, is situated at the bottom of it; but, instead of the belt, the trough is carried, by being fixed transversely across two long rails, which, at the fore-end, have the wheel between them, and the other ends are formed into handles, by which the sower supports the machine, and wheels it before him in the same manner as a wheel-barrow. A pinion is fixed on the axle of the wheel close to the side of it, and turns a wheel and spindle, extending to the wheel on the axis of the trough, to keep the same in constant motion, and deliver the seed regularly upon the ground, in proportion as the machine advances; and means are provided by which the rate at which the axle delivers the seed can be increased or diminished at pleasure, to distribute more or less seed upon the ground.

Another class of sowing-machines are called dibblers, and are intended to make a small round hole to receive the

seeds, and then to drop them into it. We have seen several attempts to perform this operation by machines, but they have not fully succeeded. One of them was by means of a wheel provided with points projecting from its circumference, and placed at such distances from each other as the holes were intended to be. The machine being wheeled along in the same manner as a wheel-barrow, the points of the wheel were intended to dibble or pierce holes in the ground over which it passed, and the machinery in the feed-box, which was fixed upon the handles behind the wheel, followed, and let fall the intended quantity of seed into each hole so made. The objection to this machine was, that the points of the wheel, in lifting up or drawing out of the ground, drew up with them lumps of earth, and soon clogged the whole.

An ingenious dibble or sowing-machine, for acorns, was presented to the Society of Arts by Mr. Waistell in 1811, an account of which is published in their Transactions for that year. The dibble, or piercer, which makes the hole in the earth, is an iron rod, a quarter of an inch in diameter, and about four feet in length, round pointed at the lower end, that it may penetrate the ground. At the upper end of the rod a handle is fixed, to draw it up and force it down by. This rod is contained within the hollow of a wooden tube or staff, of the same length as the iron rod, and about two inches in diameter externally, so that the iron rod can be drawn up and down therein in the same manner as a rammer in the barrel of a musket: the lower end of the staff terminates in an iron tube, to which the iron rod is closely fitted, and the tube is made taper on the outside. The point of the dibble, when put down into the tube, projects a very small quantity beyond the end of the tube, and the whole is formed to a regular conical point, proper to pierce the ground. On one side of the staff a tin tube is united to it, and communicates sideways with the interior passage, or bore of the staff, at about six inches from the point. This tube is continued nearly up to the top of the staff, and is within side of the same bore as the aperture through the staff.

The dibble is forced into the ground, to make the hole, by two handles, which project from it crossways, on each side, at the upper end; and on each side of its point, or rather on each side of the iron tube which contains the iron rod, and forms the point of the dibble, are fixed two wings, or leaves of iron, projecting on each side about three inches. The operation of sowing with this implement, is to force the dibble into the ground by its handles, and thus make the hole; then draw up the iron rod, so that its point rises above the place where the tin tube communicates with the interior passage of the staff, and drop the acorn down the tin tube, and it will pass through that communication, and drop into the hole; the rod being pressed in again, carries the acorn down to its place, in the bottom of the hole made by the point of the dibble. In drawing out the dibble from the ground, it must be gently turned round backwards and forwards, by which means the wings, or leaves, projecting sideways from its point, will loosen the surrounding earth, and cover up the acorn.

A great advantage proposed by the inventor of this implement is, that acorns can be planted by it in the middle of any bush, without first removing it. For this purpose, the dibble is to be pressed down into the ground through the bush; then raising up the rod, so that its point will be raised above the point of communication between the interior of the tin tube and the cavity of the staff, an acorn is to be dropped into the tin tube, which will fall down

through the tube into the hole made by the point of the dibble. In drawing up the dibble out of the ground with the motion above-described, the earth will be covered in upon the acorn. Thorns, bushes, and thickets, says Mr. Waitell, are the natural guardians of young oaks from the depredations of cattle of all kinds, in forests and other grounds where they pasture; and by this means, acorns may be deposited in the interior of bushes, as well as in open grounds, with rapidity and accuracy.

SOWING-Plough, that instrument of this kind which is employed for the purpose of sowing, or of forming the land in a proper manner for the seed being put into it, after it has undergone the necessary ploughing. There are many ploughs of this sort in use in different districts of the kingdom, and they are constructed in several different ways in different places, and with very different numbers of shares, or contrivances for forming the little drills, or small furrow-openings in the land, which are to receive the seed. They are made with three, five, seven, and nine of these shares or parts, according to circumstances, and the intentions of sowing which they are to serve. Low iron wheels, in combination with tines or teeth, are sometimes likewise made to answer the purpose of forming the little openings for the feed in these ploughs. And they have many other variations in their structure in other parts. These kinds of sowing-ploughs are now beginning to make their way, somewhat rapidly, in the mouldering chalky-land districts of the country, particularly where the soils are of a light, dry, friable nature. They constitute, in some measure, a plan between the drill and broad-cast methods of sowing, as the seed is sown or scattered over the land by the hand, after it has been furrowed by the plough in a suitable manner. The Berkshire nine-share sowing-plough is said to be used with the most beneficial effects. After the land is properly prepared and rolled, this plough is passed over it, and the grain or other seed sown broad-cast and harrowed in; by which means it comes up, it is observed, with as much regularity as if it had been drilled. It is indeed suggested, that in many soils and situations this sowing-plough might undoubtedly be found preferable to the best drill-machine. See **SOWING**.

The pressing-plough, and probably some others, are of this kind, though they may possess other highly useful properties, in different intentions. See **Pressing-Plough**.

The utility and preference in favour of these sorts of sowing-ploughs, probably, in a great measure, depend upon their being attended with but little labour, trouble, or difficulty in the performance of the business, and their requiring little knowledge in the persons who conduct and manage them. There may also be something on such light soils, in their rendering the land more solid, in putting in some sorts of crops, as those of the wheat kind, &c. See **TREADING and WHEAT**.

SOWING-Roller, that sort of implement of this kind which is constructed for the purpose of sowing different sorts of grain and feeds. Implements of this nature have been lately contrived, and formed in several different modes and manners, in the view of effecting this intention in a more complete and satisfactory manner than has been commonly the case formerly. They are, however, for the most part, still defective in all or some of the ways which have been noticed in speaking of sowing-machines, and to be remedied, most probably, in the ways, and by the means, which have been there suggested and pointed out. See **ROLLER**.

In a sowing-roller which has been lately invented, the heavy expence commonly attendant upon constructing such implements, and their being mostly applicable only to one particular purpose, has induced the inventor to fix and

attach a complete feed-distributing apparatus to the common field-roller, which is capable of feeding, it is said, any given number of little rows or furrows made in the ground by itself, or of sowing the land broad-cast, if that mode should be preferred. This sowing implement, which is wholly formed on the above principles, from its very great powers, the ease with which it may be constructed, being such as that any tolerable good village wheelwright may put together, and the little liability there is of its being out of order, warrant, it is supposed, the assertion, that it is a more effectual sowing tool than any which has yet been offered to the public. It is in this case calculated and constructed on a narrow scale, that is, with a roller of only four feet two inches in length, and twenty-eight inches in diameter; as such a block of wood is easily to be procured in almost any situation, but it may be formed of much larger dimensions.

This sowing-roller consists of a roller-part, the gudgeons of which pierce the shafts of the tool, and after passing through them about two inches, are bent at right angles, so as to form cranks, which, by means of parallel bars of communication, give a rotatory motion to a tin cylinder, which, for the sowing of small seeds, such as those of turnips, rape, cabbage, clover, and others of the same nature, may be about a foot in diameter, but for different sorts of grain larger, and perhaps somewhat differently modified. This tin cylinder is to be shut at each end, by means of a piece of stout board, turned so as to fit exactly, and to be fastened in with very great nicety and firmness. The whole surface of it is to be pierced with small holes, so that when it is furnished with seeds, the revolutions of it may cause them to pass through into the funnel for their distribution. It is also internally divided and separated by several diaphragms of the tin kind, by which the feed is prevented, when the implement is on a declivity, from being thrown all to one end of the cylinder, by the force of its own weight or gravity. Each compartment is provided with a small slider, which moves in a groove internally, by means of which it is supplied with feed when it is wanted. The axis, or axle-tree, is square, from the end or place of its entrance into the cylinder, to that of its exit at the opposite end. Both ends of this axis, as well as those of the gudgeons in the ends of the roller, are turned for cranks; but in order that there may be no possible check given to the motion of the cylinder, the two cranks, that is those of the roller and of the cylinder, on the right side of the implement, are to be set at right angles with the direction of those on the left side of it, so that when the former are vertical, the latter will be horizontal; as is seen to be the case in many pieces and sorts of machinery, as in those of windlasses for pits and wells, hand-mills, and some others, where two persons are employed, one at each end of the power which gives the motion.

There is a strong plank, about two inches in thickness, and two feet at least in depth, which reaches all across the tool; the whole of it that is above the shafts, resting upon them by means of a shoulder at each end. It is supported by a strong iron stay, as it is a part which must be very firm, on account of the whole stress of the shares bearing upon it. All of it that is above the shafts, which need not be more than eight inches, serves as a foot-board, while that part which is under the shafts forms the front part of the feed-funnel. A strong wooden slip or strap, for a support, should be fastened firmly, at its upper end, to the side of the shaft, taking care that it be out of the way of the crank on the axis of the roller. The other end may be fixed as a buttress, at the back of the projecting elbow of the above plank or board, so as to strengthen and enable it to resist the

the pressure occasioned by the action of the shares. The back part of the funnel is formed by a thin deal board, which is secured at its upper part to the shafts. The sides of the funnel are closed under the shafts with moderately thin deal boarding. The funnel, when ready for directing the feed, reaches within four or five inches of the ground; it has no bottom, so that when the implement is in motion, it will, in this state, sow broad-cast with much regularity and exactness. When thus employed, however, instead of having the chain which hangs in loops, at six inches apart, all along the bottom part of the back-board, for the purpose of covering in the feed, and filling up the little furrows made by the shares in the business of drill-sowing, a broad but short harrow is to be fixed to, and appended from, the bottom part of the back-board, which, passing before the roller, covers the broad-cast work, which is immediately afterwards compressed by the roller coming over it, and finished. It must be noticed, that the loops of the chain used in drill-sowing hang in those parts of the back-board that lie over the intervals between the small furrows. This is managed by having a number of tenters, into which a long chain may be looped, as the occasion may require. The shares have each a standard, the latter being long enough to measure the whole depth of the front board or plank noticed above. The foot part of these spreads a little at the heel, so that it may stand open to about two inches and a half at that part; the length of the sole part may be five inches, and the step about three inches, the point and the upper part being sharp. At the back part of each standard are two slit-springs, which serve to keep them tight, when they are put into the groove in the front board or plank. At the top, in the front part, for about eight inches downwards, the standards are furrowed in an horizontal manner, so as to form teeth or cogs, which fit into the grooved bar that passes all across the tool, whereby the several standards, and

the shares that are fixed to them, are capable of being either raised or lowered. This is effected by means of the small winch handle. There are two rows of staples driven through the front board or plank, and rivetted firmly within the funnel. These staples should admit the standards to pass up them from below, when fitting into their places, and should fit them exactly in breadth; but in depth some allowances should be made for the play of the two back springs. The upper row of staples should be just between the shafts, the lower one within four inches of the bottom of the board. Great care should be taken to place those in the upper row perfectly in a line with those below; and both lines should be in a correct parallel with the grooved bar, otherwise they never will work up and down so freely, or in so proper a manner, as they ought to do. The standards should be about half an inch in breadth and nearly an inch in depth, from front to back, exclusive of the slit-springs, which are not to be rivetted, but welded on, that they may not weaken the standards, which must also be perfectly smooth and straight. The number of the staples in each row is seventeen; but as it is supposed that six inches will be as small an interval as will ever be wanted in this method of sowing by means of drills, no more than nine shares can ever be required for the purpose.

The tabular form and representation which is introduced below will give a clear view of the manner in which the shares should be distributed in the seventeen sets of staples, which are calculated for sowing any number of rows in this implement; considering always that the tool, in returning, must pass more or less distantly from its preceding track, according as the vacancies on the right of the row of shares may indicate: thus, for instance, when sowing at a foot interval, as both ends of the line will bear shares, a foot distance should be allowed, as is exemplified in the third column below.

Sowing-Distance Table.

Staples.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	In return- ing leave a space of
Intervals of six inches.	+		+		+		+		+		+		+		+		+	Six inches.
Nine inches.	+			+			+			+			+			+		Six inches.
Twelve inches.	+				+				+				+				+	Twelve inches.
Fifteen inches.	+					+					+					+		Nine inches.
Eighteen inches.	+						+						+					Three inches.
Twenty-one inches.	+							+							+			Twelve inches.
Twenty-four inches.	+								+								+	Twenty-four inches.

It is to be noticed, that the crosses in the above table shew in which of the staples the shares should be set, in order to sow at the distances expressed in the first column of it; all

the other shares may be drawn up, or wholly taken out and removed.

The staples are counted from the left of the implement; calling

calling that which is nearest to the winch of the cylinder of it the first. The driver is also considered as beginning on the left of the field, and making up the broken parts, on the right of the numbers, &c. by preserving about the distances specified in the right-hand column of the table, taking the mark of the roller for his guide. In broad-cast work he must return close to his former track.

It remains now to be shewn how, or in what manner, the grain is brought into the little furrows made by the shares; for this purpose, the funnel is divided into sixteen compartments; and for the very same reason, to make the seed fall equally through the bottom, when the implement may be working on a declivity. But all the partitions are made to slide out, they being formed in battened grooves. This is for the purpose of introducing the *drill bottoms*, as they are called; one of which is for nine rows, and another for three. Each of them, it is said, is nothing more than a wedge-like block, which being let down into the bottom of the funnel, fits exactly at the edges; and by means of holes of a conical form, which are scooped out in it, and corresponding small tin spouts below to direct what seed they respectively receive, in a forward manner, shooting it, as it were, under the hollow heel of the share, distribute the seed into the number of furrows which are made for receiving it.

The middle hole or scoop only, however, is of equal extent to the right and left of the tin spout; the other two scoops are necessarily of a something shelving or slanting form; it being indispensable to allot to each spout an equal surface on the block; and to shelve the scooping to the spot where its spout is fixed.

The drill bottoms may thus be changed at pleasure; the partitions will keep them duly in their places. But although there are sixteen compartments in the funnel, no more partitions are to be used than may be necessary to correspond with the number of scoops and spouts in the drill bottom. It is to be remembered, that, as there will be seed falling from the whole length of the cylinder into the funnel, and that as there will be occasionally a portion of the drill bottom parted off, which has no spout, such compartment should when necessary be emptied, and the seed be put into those divisions only of the cylinder which are over the spouts.

The two shafts of the tool are connected firmly together by a strong thwart or tie, and which, when the other parts are united with it, render the whole completely substantial. Under the hinder end or part of the shafts, a scraper is carried quite across, and is bolted in with the cross piece, which has an iron edge, and serves to divert the roller of the adhesive foil that would otherwise accumulate about it. The upper and under edges in the back part of the thwart are completely rounded off, so as to be semicircular. This thwart should be inserted as close as possible to the back of the cylinder; because its purpose is to aid a sheep-skin wrapper in lapping round under it, thus keeping the seed in, when the cylinder should not sow. The wrapper extends the whole way across, and should be about two feet deep; each edge, that is of the top and bottom, but not of the sides, should be affixed to a lath, in order to make it draw backward and forward in a straight line. The place should be cut to about half an inch in length, by which means it will, when passed under the cylinder with the wool side upwards, repel the seeds when they attempt to pass through the perforations. This wrapper should always be passed under, while the implement is turning at the ends of the lands; but at other times it draws over the cylinder, the flesh side uppermost, and serves to keep out wind and rain. There are two little pullies affixed into the shafts, close

under the fore-board, which serve to pass cords over, so that by the aid of the rounded back of the thwart, the wrapper may glide easily, either over or under. When brought round under the cylinder, its front lath hitches to two hooks, under the half foot-board, in order to prevent its receding, and to keep it tight to the cylinder. It may be noticed, that it is of more importance to keep the wrapper tighter to the front than to the back part of the cylinder; because the revolution of the latter being against that of the fun, the same as that of the roller's when viewed from the left side, it is obvious, it is said, the grain will cast forward, and have a tendency to relinquish the hinder part of the cylinder, as it rises in that part. It is likewise suggested, that although the axis of the cylinder in this implement is made to pass through the shafts, it would ride on them to more advantage, and render it far easier to shift the drill bottoms and the partitions in the funnel. Indeed, it is thought, that the former might be made to fit in by a flap, made to open at the bottom of the back-board.

There is a small stiff bolt affixed to a cross-piece, for the purpose of sliding into the grooves of the bar near the cylinder, so as to keep it fixed, and prevent its turning either way, when pressed by the action of the shares. In setting the shares to any desired depth, by turning the winch, the bolt must be drawn back, otherwise the grooved bar cannot turn; but as soon as it is put to the proper depth, the bolt is to be pushed in again to its opposite groove.

The ends of the cranks on the axis of the roller are split like spring keys, and have a catch, over which the hind end of the parallel iron slides, and is kept in its place. This is more clearly evident in the terminations of the same cranks. When the cylinder of the implement is not to turn, as in passing from one place to another, &c. the springs are to be pinched together, and the parallel iron to be drawn off; which is then to be hitched up to a hook at the side of the driver's seat, which seat is supported by the standards which are let into the shafts. The ends of the cranks might, it is supposed, be perforated and keyed, but these modes would not be so good as the plan which is here adopted.

It will be readily remarked, that by far the greater part of the machinery in this sowing-roller relates to the drill practice of putting in the seed; as when it is made only to broad-cast, nothing but the cylinder and two thin boards, forming a directing funnel, will be necessary. It is also suggested, that the great strength of the fore-board, already noticed, would likewise be unnecessary, as there would be no shares, no staples, nor grooved bar; and that there would not be any occasion for a drill bottom, though an immense saving of seed, and great facility of hoeing the young crops, would arise, it is asserted, from adopting such a mode of committing the seed to the soil. The tin spouts, in such case, it is supposed, should rather point backwards than forwards; for, if unprotected by preceding shares, they might be liable to injury from clods, &c.; their diameter ought to be, it is said, about an inch for white corn, but that for small seeds half an inch might answer better and in a more perfect manner. The harrow, prepared with a sufficient number of sharp tines, suited in length to the kind of seed, would cover it sufficiently; and the roller would finish the work in a complete manner. Thus, if corn were sown at nine inches or a foot asunder, it would, it is contended, be so little disturbed by the harrow, as to come up in rather broad lines, but with interval enough for the free action of a six-inch hoe. It is farther also to be well noticed, that, as the roller and the cylinder each revolve in the same period of time, that the larger the cylinder, the more seed will be sown; unless a small one be more pierced, that

that is, have more holes in it, in proportion as it is smaller than the roller. In the proportions which have been made use of in the above instance, the roller being twenty-eight inches in diameter, its circumference will be more than seven feet, whereas the cylinder is but one foot in diameter, therefore little more than a yard in circumference. Consequently, as the roller will pass over full seven feet of ground, while the cylinder presents only three feet of revolving surface, the latter must be so much pierced as to allow the seed to fall *very freely*, otherwise the ground will be but thinly sown, and the business, of course, imperfectly performed.

The one-foot cylinder has been already considered, and suggested as being the most applicable to small seeds, and which the considerations just stated seem more fully to confirm. They likewise seem to strengthen the suggestion, that, for white corn, peas, and other similar sorts of articles, the cylinder would be more suitable, if it were enlarged, according to the number of pecks or other measures required to sow an acre. It is a necessary caution that, in sowing with this implement, the cylinder be never filled too full; it ought indeed, in no case, to be more than three-fifths filled, and, if only filled up to the axis of it, so much the better. While the seed is putting in, which should be done by means of a short, broad, tin funnel, the wrapper should be passed under the cylinder to keep it in, as seen in describing the tool.

It is suggested further too, that, by previously setting the centre shares of the implement rather higher than those towards the sides, which may be easily done by taking out the grooved bar, by unkeying the strap by which it is held down into the box near the winch, it may be made to sow on narrow ridges, which is very necessary and desirable in different situations, but it will then require that a suitable roller should be used; or by setting the middle shares deep, pulling off those towards the sides, the implement might be made to work with a common furrow-roller. In either case the points and tops of the shares should, it is said, form a curve corresponding with the shape of the roller, but more especially where the ridges are very narrow, and much raised in the crown.

It is obvious, the inventor says, that the whole of the above sowing apparatus is capable of being attached to any common well made *field-roller* which is of a good size in the barrel, and fitted into a proper frame, with a seat, and other necessaries; and that every part of the broad-cast machinery may be connected with it at very little expence. These are very important considerations in such sorts of tools; but, besides, the roller will still be a roller, and useful as such; while the sowing part, being only necessary when that operation is to take place, may at other times either be left at rest, or be altogether removed.

It is stated in conclusion, that by means of this sowing-roller, the work of sowing, harrowing, and rolling may go on all at one time, and that, by a change of horses once in the day, a field of ten acres may be easily sown and finished in that time. That in hot dry seasons, when farmers are under the necessity of catching and taking the advantage of smart showers, for the sowing of their turnip seed in particular, a tool that is capable of effecting so much cannot but be highly useful. The land will not only be better and more expeditiously sown, but be left in a more suitable state for preventing the effects of the weather. It will probably too not be much less beneficial for the purposes and intentions of sowing in other cases.

The great power, together with the ready and extensive application of the roller, hold out to the agricultural mechanic, means which ought not to be overlooked in the con-

struction of tools and machinery of this nature, as they afford prodigious facility in forming and giving them motion.

SOWINS, or SOWINGS, in the manufacture of linen-cloth, are used in a rather coarse and pretty thick but not over thick state, by weavers, in dressing and preparing their yarn of this kind for the loom, or being woven into cloth. It takes away, combines, and hardens the loose parts of the threads or *sleepings*, as they are called, and gives a sort of body to the whole divided parts of the yarn before the operation of weaving begins to be performed, and consequently greatly facilitates the work. In this process or practice the best flour is likewise sometimes employed in the same way, as going farther and answering better, especially for fine cloths.

SOWLEE, in *Geography*, a town of Bengal; 17 miles E. of Boglipoor.

SOWNE, a term used in the exchequer; seeming to be a corruption from the French *souvenu*, *remembered*.

Such estreats and casualties as the sheriff by his industry cannot get or levy, are said to be estreats that *sowne* not, that is, are not to be remembered, or are not in demand. On the contrary, estreats that *sowne*, are such as he may gather.

SOWRAY, in *Geography*, a town of Hindoostan, in the circle of Chanderee; 40 miles S.E. of Chanderee.

SOWREE, a town of Hindoostan, in Bengal; 15 miles N.E. of Jellalore.

SOXALÆ, or CAMELOBOSCI, in *Ancient Geography*, a people of Germany, who inhabited the vicinity of the deserts. Ptolemy.

SOXINI, or SOCCINI, MARIANO, in *Biography*, denominated the elder, an eminent canonist, was born at Siena in 1401. He studied first at his native place, and then in Padua, in which last university, after he had taken his degree, he was for some years professor of the canon law. He then returned to Siena, where he taught as a professor during the remainder of his life. He was very intimate with Eneas Sylvius, afterwards pope Pius II., who has written a panegyric upon him in one of his letters in the most magnificent terms, assigning to him almost universal proficiency in science and the arts, with the greatest excellence of moral character. Soxini was sent by the state to compliment Sylvius when he ascended the papal throne, on which occasion he was nominated consistorial advocate. He died in 1467, leaving behind him a considerable reputation for learning and integrity. His works, consisting of "Consultations," "Commentaries on the Books of Canon Law," and tracts upon "Legal Subjects," have been frequently reprinted.

SOXINI, or SOCCINI, BARTOLOMEO, a celebrated civilian, son of the preceding, was born at Siena in 1436. He studied the law under different masters at Siena and Bologna, and after he had been admitted to a doctor's degree he became professor of the civil and canon law in his native city. He was, in 1473, invited to Pisa, where he taught both branches of law, and in this city he resided twenty years, with some occasional absences. He took an active part in the civil dissensions of Siena, and was, at one time, in the list of the banished citizens. He was employed in embassies from the Siense to the Florentines, and it is said he engaged in a military attempt to change the constitution of Siena. At Pisa the famous Jason del Maino was his rival, and they held frequent public disputations, at one of which Lorenzo de Medici was an auditor. Jason being hard pressed by the arguments of his antagonist, quoted, in his own favour, a text which he had invented for the occasion. Soxini, with equal readiness, in-

vented another to oppose it, and being asked by Jason where he had found it, "Next to that which you have just now quoted," he replied. The fame which he had acquired caused him to be invited to Padua in 1489, with the offer of a large salary, which he determined to accept, but his intentions being known he was detained. For some time he was professor at Padua. He died in 1507, having been three years deprived of the use of his speech. His works as an author were "Consultations," "Comments on the Code and Digest," the "Rule of Right," and other pieces of a similar kind. He was not estimable as a practical moralist. He was addicted to gambling, and would sometimes leave his scholars without a lesson, and pass whole nights at the gaming table, the consequence of which most destructive habit was, that he did not leave money enough behind him to pay the expences of his funeral. He was extremely greedy of money, charged very high for his opinion, which he would sometimes give to both parties in a suit. He was free of speech, sarcastic and jocular. His faults were borne with on account of his high professional character. Angelo Politiano, speaking of his intended correction of the Pandects, says, "I must have recourse to the assistance and advice of that singularly excellent doctor of Siena, Bartolomeo Soxini, whom I may boldly denominate the Papinian of our age."

SOXINI, MARIANO, denominated the younger, grandson of the first Mariano, was born at Siena in 1482: he studied the law under his uncle Bartolomeo, and after taking his degree, taught alternately the civil and canon law at his native city, till he removed to Paris in 1517. Returning to Siena in 1524, he was employed as ambassador to the republic of Florence, and also to pope Leo X. He was engaged in the following year by the republic of Venice, to occupy a professorship at Padua. He remained at that university till the year 1542, when the offer of a higher salary drew him to Bologna. Here he continued till his death, though he received the most flattering invitations, with the promise of large salaries, from Cosmo, duke of Florence, the king of Portugal, and other princes and states. He died in 1556, and his German scholars in Bologna shewed their respect for his virtues and talents, by carrying his body on their own shoulders to the tomb. He was author of many works, which were once in considerable estimation, though they are now forgotten.

SOXINI, LELIO, son of the preceding, was born at Siena in the year 1525. He was destined by his father for the legal profession, but having in the course of his studies attended to scriptural truths, he felt reason to question the validity of the doctrines of the Catholic church. For the purpose of farther enquiry, he made himself acquainted with the languages in which the Old and New Testament were written, also with the Arabic and other oriental languages. About the year 1546 he joined himself to a society attached to the principles of reformation in religion, and the members of which speculated very freely on the mysteries contained in the doctrines of the Trinity, and the atonement. Their objects being discovered, some were apprehended, and others gladly fled from the iron arm of persecution. Two of those who fell into the hands of the priests suffered death as heretics, and those who remained concealed themselves, or withdrew into foreign countries. The subject of this article quitted Italy in 1547, and travelled during the four following years into France, England, Germany, and Poland. He then fixed at Zurich, where he maintained a correspondence with the reformers in various parts of Europe, by whom he was held in high esteem, till he shewed a leaning to the doctrines of Arianism. Calvin, who was ever

eager in detecting heresy, wrote him a letter of admonition, which was followed by a still stronger warning, the burning of Servetus, and which was sufficient to deter Lelio from taking a very active part in propagating the doctrines to which he adhered. On the death of his father, in 1556, he obtained letters of legation from the king of Poland to Venice and Florence, which enabled him to settle the affairs of his inheritance. He died in 1562. He was mild and gentle in disposition, averse from all controversy, and was evidently led by conscience to differ from those with whom he lived. Some writings have been attributed to him, but critics are very doubtful as to what he really wrote. Bayle.

SOYDE, in *Geography*, a town of Norway; 36 miles N. of Stavanger.

SOYDPOUR, a town of Bengal; 25 miles S.W. of Silhet.

SOYLAND, a township of the parish of Halifax, Yorkshire. See HALIFAX.

SOYOLLA, the principal island of a cluster in the Red sea. N. lat. 14° 2'. E. long. 59° 38'.

SOYON, a town of France, in the department of the Drôme, on the Rhone; 6 miles S. of Valence.

SOZ, a river of Russia, which runs into the Dnieper, 16 miles S. of Bilitzi, in the government of Mogilev.

SOZO, in *Ancient Geography*, a town of Asia, in the interior of Media. Ptolemy.

SOZOMEN, HERMIAS, in *Biography*, an ecclesiastical historian, contemporary with *Socrates* (see his article), was born of respectable parents, as some say at Salamis, in the isle of Cyprus, but according to others, at Gaza or Bethelia, in Palestine. Having studied the law at Berytus, he practised as an advocate at Constantinople, devoting his leisure hours to the composition of his ecclesiastical history. This work contains, in nine books, an account of the affairs of the church, from the third consulship of Crispus and Constantine, Cæsars, to the 17th consulship of Theodosius the emperor, in whose time he wrote, and to whom he dedicated his performance; that is, from the year 324 to the year 439, or during a period of 115 years. Cave represents him as flourishing about the year 440. In his history, which is written in a more florid and elegant style, but with less judgment, than that of *Socrates*, he has introduced many eulogiums of a monastic life, to which he was attached in consequence of his education among monks, and he has added many narrations of the actions and manners of the recluses, and his testimony to the early practice of public penance in the Roman church, together with a detail of the particular ceremonies of which it consisted. To the orthodox, however, he has given offence by his commendations of Theodore of Mopsuestia, with whom originated the heresy of two persons in Christ. His history is chargeable with several notorious errors in the relation of facts. He is supposed to have died about the year 450. Sozomen's history is printed with that of *Socrates*, and the other Greek ecclesiastical historians. A work of Sozomen, not now extant, containing, in two books, a summary account of the affairs of the church, from the ascension of Christ to the defeat of Licinius, was written before his history. In moderation and candour Sozomen resembled *Socrates*; and it is true of the former, as well as the latter, that he always speaks with great respect of the sacred scriptures. Dupin. Lardner.

SPA, or SPAW, in *Geography*, a town of France, in the department of the Ourte, belonging to the bishopric of Liege, in Germany, and situated in the marquisate of Franchimont, on a small river which runs into the Ourte. It was formerly a small village, but since the discovery of

its mineral waters, about the year 1326, and the celebrity which they have acquired, it has been considerably enlarged; and now consists of two streets, joined by a bridge over the stream that runs through it, together with several smaller streets and rows of houses; those of more ancient date being irregularly arranged, and constructed of wood and plaster, and the more modern built with brick and stone. The soil about the town is rocky, gravelly, or loamy, intermixed more or less with iron ore. The country about it abounds with hills and woods, so that it is not fertile in grain, but it has plenty of sheep, kine, and poultry, and great quantities of game, and the streams furnish an ample supply of various kinds of fish. During the season in which the waters are used, the town resembles a fair in its variety of booths, toys, &c. Its vicinity affords pleasant and salubrious rides, and many agreeable and romantic walks: and its visitors are gratified with evening amusements in public rooms adapted for this purpose. Some have supposed that the medicinal waters of this place are those that are mentioned by Pliny in his "Natural History," but others apprehend that those were the waters of Tongrés. These waters were at first the property of the community of Spa, but they were afterwards taken possession of by a bishop of Liege, until an appeal was made to the imperial chamber, which restored them to the original proprietors, who impose a small duty on every flask exported under their seal. In the year 1794, Spa was taken by the French; 16 miles S.E. of Liege. N. lat. 50° 31'. E. long. 5° 30'. The waters are furnished by various springs. Those of the Pouhon spring have been preferred, by our chief physicians, to any others in or near the country of Liege; particularly to the waters of Bru, which they complain have been imposed on the public, to their and their patients' frequent disappointment.

However, as the Spa waters are impregnated with different proportions of the same ingredients, they may be chosen differently, according to the intentions with a view to which they are used. The Pouhon is the strongest chalybeate. This is in its most perfect and natural state in cold dry weather; but in warm moist weather it loses its transparency, appears turbid or wheyish, contains less fixed air, or carbonic acid gas (see *CARBONIC Acid*), and is partly decomposed. This water, which is colder by many degrees than the heat of the atmosphere, is supposed to contain the greatest quantity of fixed air of almost any acidulous water; and in consequence of this ingredient, it has a remarkable sprightliness and viscosity, and boils by mere warmth; but this soon flies off if the water be left exposed, though it may, in a great measure, be preserved in well-corked bottles. It is capable of dissolving more iron than it naturally contains, and of thus becoming a stronger chalybeate, on account of the great quantity of fixed air which it contains: and for the same reason an ebullition is raised in it on the addition of acids, which disengage its fixed air. This water mixes smoothly with milk, whether it be cold or of a boiling heat.

The Tonnelet and Geronsterre waters are weaker chalybeates, but brisker and more spirituous. The Groesbeck, Sauveniere, and Wartroz, are still weaker chalybeates, but highly impregnated with calcareous and selenitical earths, and contain also a greater proportion of the fossile alkali. The Geromont is likewise a weak chalybeate, but contains a great deal of calcareous and selenitical earths, and about three times as much alkaline salt as any of the others. The four last waters, therefore, will be better in disorders arising from an acid cause, and as diuretics, particularly the Geromont. The Bru, or Churon water, approaches to the nature of

the Tonnelet, and though it has been decried, is said, in consequence of every trial, not to be inferior to any of the Spa waters.

All the waters that are comprehended under this denomination, abound with fixed air; they also contain more or less iron, fossile alkali, and calcareous and selenitical earths, together with a small portion of sea-salt, and an oily matter common to all waters. All these ingredients are kept suspended, and in a neutral state, by means of the fixed air, on which the virtues chiefly depend; though they are probably rendered more active and penetrating, both in the first passages, and also when they enter the circulation, by means of that small portion of iron, earth, salt, &c. with which they are impregnated.

These waters are diuretic and sometimes purgative; and, like other chalybeate waters, they tinge the stools black. They exhilarate the spirits much better than wine or spirituous liquors, and their general operation is by strengthening the fibres. They cool and quench thirst much better than common water.

They are found excellent in cases of universal languor or weakness, proceeding from a relaxation of the stomach, and of the fibres in general, and where the constitution has been weakened by diseases, or by a too sedentary life; in weak, relaxed, gross habits; in nervous disorders; at the close of fits of the gout and rheumatism; in such asthmatic disorders and chronic coughs as proceed from too great a relaxation of the pulmonary vessels; in obstructions of the liver and spleen; in scorbutic and other putrid disorders; in hysterical and hypochondriacal complaints; in paralytic disorders; in gleets; in the fluor albus; in fluxes of the belly; in the gravel and stone; in female obstructions; in barrenness; and in most other cases where a strengthening and brisk stimulating resolving chalybeate remedy is wanted: but they are generally hurtful in hot, bilious, and plethoric constitutions, when used before the body is cooled by proper evacuations; they are also hurtful in cases of fever and heat, in hectic fevers, and ulcerations of the lungs, and of other internal parts, and in most confirmed obstructions attended with fever. The usual season for drinking them is in July and August, or from May to September. The quantity to be drank is such as the stomach can bear without heaviness or uneasiness; but it is advisable to begin with drinking a glass or two several times in a day, and so increase the quantity daily, as the stomach can bear; and during the course to continue that dose, and to diminish the quantity at the close in the same degree as it was augmented at the beginning. Moderate exercise is proper after drinking. Previous to the use of the water, the first passages should be cleaned by gentle purges, and, if necessary, an emetic should be given; and during the course, costiveness should be prevented, by occasionally adding Rochelle salts or rhubarb to the first glasses of water in the morning; and a cooling regimen should be observed.

The Spa water is also used externally, in a variety of cases, with good success. It is used as an injection in the fluor albus, and in ulcers and cancers of the womb, and also in the gonorrhœa; it is serviceable for washing venereal aphthæ, and ulcers in the mouth, phagædenic ulcers, by way of gargle for relaxed tonsils, and for fastening loose teeth, and in other cases of relaxation. It is also said to cure the itch, and similar complaints, by washing and bathing, an internal course being observed at the same time. Elliott's *Mineral Waters*, p. 201, &c.

The town of Spa being resorted to by persons from all parts of Europe, on account of its waters, has always been allowed a neutrality during the hottest wars.

SPAAD, or **SPALT**, *Spatum*, a word used in several different senses; sometimes for a species of English fibrous talc, or of gypsum; and sometimes for spar.

The various kinds of spaad are found pretty frequently in England and Germany, and sometimes brought from the Levant: they are all soft, and easily pulverized.

SPACE, **SPATIUM**, a simple idea, the modes of which are distance, capacity, extension, duration, &c.

Space, considered barely in length between any two bodies, suggests the same idea which we have of distance.

If it be considered in length, breadth, and thickness, it is properly called *capacity*.

When considered between the extremities of matter, which fills the capacity of space with something solid, tangible, and moveable, it is then called *extension*.

So that extension is an idea belonging to body only; but space, it is plain, may be considered without it.

Space, therefore, in the general signification, is the same thing with distance considered every way, whether there be any solid matter in it or not.

Each different distance is a different modification of space; and each idea of any different space is a simple mode of this idea. Such are an inch, foot, yard, &c. which are the ideas of certain stated lengths, which men settle in their minds for the use, and by the custom of measuring. When these ideas are made familiar to men's thoughts, they can in their minds repeat them as often as they will, without joining to them the idea of body, and frame to themselves the ideas of feet, yards, and fathoms, beyond the utmost bounds of all bodies; and by adding these still to one another, they can enlarge their idea of space as much as they please.

From this power of repeating any idea of distance, without being ever able to come to an end, we acquire the idea of immensity.

Another mode, or modification, of space, is taken from the relation of the parts of the termination of extension, or circumscribed space, amongst themselves; and this is what we call *figure*. This the touch discovers in sensible bodies, whose extremities come within our reach; and the eye takes, both from bodies and colours whose boundaries are within its view; where, observing how the extremities terminate, either in straight lines, which meet at discernible angles, or in crooked lines, in which no angles can be perceived; by considering these as they relate to one another, in all parts of the extremities of any body or space, it acquires the idea we call figure, which affords to the mind infinite variety.

Another mode belonging to this head is that of *place*; which see.

Another mode of space is the idea which we get from the fleeting, and perpetually perishing, parts of succession, which we call *duration*.

Space is usually divided into *absolute* and *relative*.

SPACE, *Absolute*, is that considered in its own nature, without regard to any thing external, which always remains the same, and is infinite and immoveable.

SPACE, *Relative*, is that moveable dimension or measure of the former, which our senses define by its positions to bodies within it; and this the vulgar use for immoveable space.

Relative space, in magnitude and figure, is always the same with *absolute*; but it is not necessary it should be so numerically: as if you suppose a ship to be, indeed, in absolute rest, then the places of all things within her will be the same absolutely and relatively, and nothing will change its place; but suppose the ship under sail, or in motion, and

she will continually pass through new parts of absolute space: but all things on board, considered relatively, in respect to the ship, may be, notwithstanding, in the same places, or have the same situation and position, in regard to one another.

The Cartesians, who make extension the essence of matter, assert, that the space any body takes up, is the same thing with the body itself; and that there is no such thing as mere space, void of all matter, in the universe; but this see disproved under **VACUUM**.

The Cartesians, who do not allow of any distinction between space and matter, were naturally enough led to the opinion, that space or extension was a substance. Others, who admit a vacuum, and consequently an essential difference between space and matter, assert also that space is a substance. Among these we find s'Gravesande, *Introd. ad Philos. sect. 19*.

Others put space into the same class of beings as time and number; that is, they make it to be no more than a notion of the mind. Hence, according to these authors, absolute space, of which the Newtonians speak, is a mere chimera. See the writings of the late bishop of Cloyne, *passim*.

Space and time, according to Dr. Clarke, are attributes of the Deity, and the impossibility of annihilating these, even in idea, is the same with the necessary existence of the Deity. See Watt's *Phil. Ess. Ess. i*.

SPACE, in *Geometry*, denotes the area of any figure; or that which fills the interval or distance between the lines that terminate it.

The *parabolic* space is that included in the whole parabola.

The *conchoidal* space, or the *cissoidal* space, are what are included within the cavities of the conchoid and cissoid. By the new methods now introduced, of applying algebra to geometry, it is demonstrated, that the conchoidal and cissoidal spaces, though infinitely extended, are yet finite magnitudes.

SPACE, *Cycloidal*. See **CYCLOIDAL**.

SPACE, *Elliptic*. See **ELLIPTIC**.

SPACE, in *Mechanics*, the line a moveable body, considered as a point, is conceived to describe by its motion.

SPADA, **LIONELLO**, in *Biography*, was born at Bologna in 1576, in a very low condition of life; and when a boy he became the servant of the Caracci, and ground and prepared their colours. The constant opportunity he possessed, whilst with these great men, of seeing pictures, and hearing discussions on the principles of the art, roused a latent disposition to study and design, which his masters saw and encouraged; and at length they admitted him into their academy, where they had the gratification of seeing him become one of their most eminent disciples; though he never arrived at any very great degree of grandeur or purity of invention. His style is a compound of the Caracci and Caravaggio's manners, and is wrought with great boldness. His principal productions are, The Miraculous Draught of Fishes, in the refectory of S. Procolo at Bologna, and St. Dominic burning the forbidden Books, for the church of that saint, in the same city. This last is considered as his very greatest work. The latter part of his life was passed at Parma, in the service of the duke Ranuccio. He died in the 46th year of his age, in 1622.

SPADA, in *Geography*, a cape of the island of Candia; 24 miles N.W. of Canea.

SPADE, in *Agriculture* and *Gardening*, a well-known sort of tool, employed in digging the land. There are several forms and kinds of them in use for different purposes, as those of common digging, draining, and making of earth fences,

fences and embankments of different sorts, as well as many others, in the former of these arts. The most handy and convenient form of them, for common work, is probably that in which they are made strong in the back, and have a slight bend or curve in the handle or shaft, as by means of this the labour is performed with greater ease and facility. Various forms, shapes, and sizes of spades are had recourse to in performing the operations of draining, mound-fencing, and embanking, according to circumstances; as well as in particular works of other kinds. See SPADE, *Draining*.

The spade is also an useful garden implement, which is used for digging and preparing the soil for the reception of all sorts of seeds and plants. There are several sorts and sizes of spades occasionally employed in this art, though the common large digging spade is, in most places, almost commonly used for all kinds of digging and spade-work, which, however, in many instances, cannot be so conveniently used as a middling or small spade; it is, therefore, eligible for every garden to be furnished at least with three different sizes of spades, to suit every department of gardening the more commodiously; such as the common large digging spade, for all common digging and spade-work; a middling and a small spade, for digging particular narrow compartments, and between small plants closely placed in beds and borders, &c.

The first sort is usually from fourteen to fifteen inches long in the plate, and nine broad, narrowing gradually half an inch or an inch less at the bottom. The second sort should be about a foot long in the plate, and seven or eight inches broad. The small spade, which is about eight or nine inches long in the plate, and five wide, is convenient in pointing up or slight digging, and in fresh loosening the surface between close-placed small plants, in beds and borders, &c. where neither of the two former spades can be readily introduced: it is also useful in planting and potting many sorts of small plants, taking up small roots, and other light purposes.

And other sorts are likewise in use for different purposes, as a very small narrow spade, having the plate about seven inches long, by three and a half or four wide, which is very useful in small compartments of beds, borders, &c. containing some particular close-placed, small plants of flowers, and others, both in occasionally slightly digging, or loosening the earth between them with greater ease and effect, than a larger sized spade; also sometimes in similar compartments, in occasionally trimming round the bottom part of some straggling fibrous-rooted plants; and it is also often useful in taking up and transplanting small plants, and taking off root offsets and slips, in particular sorts, in which a larger spade would not be so convenient. And further, a semi-circular or scooped spade is another sort of a smallish size, having the plate made hollow, like a scooped garden-trowel, which is very useful in taking up small plants with balls of earth, to preserve the ball more firmly about the roots.

Proper garden-spades have the plates wholly of iron, not above a quarter of an inch thick upward, growing gradually thinner from the middle downward; the tree, or handle, being generally of ash, about two feet long, and an inch and half thick, with a firm open handle at top, formed out of the solid wood, just big enough to admit of taking ready hold.

SPADE, *Draining*, that sort which is employed for the purpose of cutting out field drains. Spades for this use are made of different breadths, so as to follow each other, and

cut the drains narrow at the bottoms. There are usually a top or upper, middle, and pointed bottom spade made use of in this work.

And there is a sort of spade or shovel, which is turned up on the sides, that is useful in taking out the small pieces of earth from the bottoms of the drains. Likewise a spade or tool of the scoop kind.

Also a wooden spade, employed in soft peaty soils, where the common draining-spades cannot be used. See SPRING and SURFACE-*Draining*.

SPADE, *Paring*, that sort of spade which is made use of in removing the sward from grass-land. See PARING Spade, and SHOVEL.

SPADE, *Turfing*. See TURFING.

SPADE also denotes any gelded beast, or a deer three years old.

SPADE-*Bit*, the quantity of earth raised by the spade in one effort. Hence probably *spit*. It also signifies the broad iron part of the spade.

SPADE-*Bone*, a term provincially applied to the shoulder-bone, probably from its being used formerly as a spade.

SPADE *Land, To*, provincially to pare ground, or break-plough it.

SPADICEOUS, or SPATHACEOUS *Plants*, in *Gardening*, those the flowers of which are protruded or produced from a sort of scabbard, or sheath, which is burst open. There is a great number of flower, as well as other garden-plants, which are of this sort, as of the former, the narcissus or daffodil and jonquil, the lily daffodil, the Guernsey lily, the aphodol lily, the sea daffodil, the different varieties of crocus, the meadow saffron, the common snow-drop, the leucium, or greater snow-drop, and many others; and of the latter, the onion, the leek, the garlick, and some others.

These are, for the most part, useful and valuable plants in either the common or flower-garden.

SPADING, in *Agriculture*, a term applied, in some districts, to the practice of taking off the sward or surface of grass-land by means of the paring-spade, in the view of burning it. It is a method which is by no means unusual in many districts, though the paring-plough mode is by far the most cheap and convenient. In the county of Devon, when the spading of the surface of a field or portion of land is determined upon in this intention, it is pared off, in a clean manner, to the extent of from three-fourths to one inch in thickness; the slices of which are then set up edgeways, and when dry, collected into heaps, or what are provincially termed beat-barrows; and by the assistance of furze, fern, heather, hedge-row, and copse faggots, or some other similar material, the whole pared substance set fire to and reduced to a mass of ashes, which, when cool, are spread, either with or without being mixed with other matters, such as lime, good mould, or the scrapings of roads, as the circumstances of the cases may require, over the land in an equal and exact manner. In this way coarse grass-lands are sometimes brought into a state of cultivation, and wheat, as well perhaps as some other crops, in different instances, well prepared for and got into the ground. See PARING and BURNING, and SOD-*Burning*.

It is, however, a tedious and laborious method of cultivating and preparing land, which can probably be only practised in particular situations and circumstances.

The paring-plough, which is designed to be introduced in the place of the tool employed in this sort of work, and which is much superior in the facility, expedition, and manner in which it performs it, has a wide-winged flat share, that measures about fourteen inches from the land-side to the

the angular point of its right side, or cutting wing. In the beam part of this implement, and preceding a sharp comb, which is welded on to the coulter-margin of the share, is a sliding-foot, fixed in such a manner as to regulate the exact thickness of the slice which is meant to be pared off, with great precision. And the share and comb of the tool being kept very sharp by frequent grinding, enable it to perform the paring of the grassy, or other surface, in a very perfect manner. This implement is held in an horizontal manner when at work, so as to cut a smooth and even furrow at the bottom part; whereas the tool usually made use of is held in an oblique direction, so as to cut the spine or green sward to a feather-edge on the furrow side, the whole of which is to be gradually lifted up, and turned, with its green side, perfectly underneath. The work is performed, in these cases, by what is commonly called splitting or dividing. See SPLITTING.

SPADIX, in *Botany* and *Vegetable Physiology*, a flower-stalk, whether simple or branched, included within a *Spatha*, or Sheath. Such occurs in the natural order of *Palme*, which tribe Linnæus principally had in view in the technical use of this term. Indeed the word, which is Greek, $\sigma\pi\alpha\delta\iota\zeta$, *palme* to the Latins, is almost exclusively applied by the ancients to the very same thing, the branched fruit-stalk of the date-palm. Linnæus, however, extends it to the *Arum* family, by a very fair analogy, though in that tribe it is unbranched; and by a further stretch of analogy, to *Acorus*. In some of the *Liliaceæ*, composing his *Spathaceæ*, though he uses the term *Spatha*, he does not employ that of *Spadix*. Jussieu and his followers have perhaps done well in excluding the *Spatha* itself from making a part of the generic character, in the natural family last-mentioned, though they retain it, as well as *Spadix*, in the *Palme*. The *Spadix*, like other flower-stalks, is solely destined to bear the flowers and fruit, and when the latter is perfected, the part in question withers and falls off. See FRUCTIFICATION, CALYX, PALMÆ, and SPATHA.

SPADO, among the Romans, differed from an eunuch only in this, that the latter was deprived both of the penis and testes, but the spado of the testes only.

SPAFFORD, in *Geography*, a township of America, in New York, situated in the S.W. extremity of Onondaga county, 13 miles S. of Onondaga; bounded N. by Marcellus and Otisco, E. by Tully, S. by Preble in Cortlandt county, W. by the Skeneateles lake, or the county of Cayuga. It was erected in 1811, from the N.W. quarter of the military township of Tully, and its population is included in that of Tully. Its area is about five miles square; the central part has an extensive valley of fine land, extending N. and S., the eastern and western extremes being hilly. The soil is chiefly a strong and productive loam; the timber, maple, beech, bass or tilia, butter-nut, and a variety of other kinds. It is well watered by springs and brooks, and has some small streams for mills, the largest of which is the inlet of Otisco lake. The first settlements were made about the year 1806, and the inhabitants are farmers from the eastern states. Here are two or three mills, and as many school-houses, in which are also held the meetings for worship. Spafford comprises as much of the military township of Sempronius as lies E. of Skeneateles lake.

SPAGIRIC, an epithet given to chemistry; which is called the *spagiric art*, or *medicina spagirica*; and to chemical physicians, who are also called *spagirists*.

It is chiefly restricted to that species of chemistry which works on metals, and is employed in the search of the philosopher's stone.

Vossius derives the word from $\sigma\pi\alpha\zeta$, *to extract*, and $\alpha\gamma\gamma\epsilon\mu\alpha\iota$, *congregate, to collect*; which are the two principal offices of chemists. Paracelsus first introduced the word.

SPAGIRICAL PHYSICIANS. See PHYSICIANS.

SPAGNOLETTO, IL, in *Biography*, the cognomen of a Spanish painter, a native of Xativa, in Valencia, whose real name was Josef Ribera. He studied for a short time under Ribalta; but, before he was sixteen, determined upon visiting Italy, to cultivate his taste, and exercise his talents in the art he had solicited for study, although he had no other means of support than what he could obtain by the exercise of his juvenile powers. It was in the 17th year of his age, in 1606, that he arrived at Naples, where he was captivated by the striking and powerful style of M. A. Caravaggio, whose favour he courted and obtained; and by whom he was encouraged and instructed during his residence in that city. From Naples he went to Parma, to see and study the works of Correggio, and thence to Rome, attracted by the reputation of Raphael and Michael Angelo; and although the influence of the style of Caravaggio still predominated in his productions, yet it was not without considerable refinement in feeling, obtained by contemplation of the works of those great men.

After a short residence at Rome, he returned to Naples, where his prospect of employment was much more favourable, partly from the number of excellent artists then practising in the former city, and probably more from the connection between the court of Naples and that of his own country, and its natural partiality to Spaniards. He was there taken under the protection of the viceroy, and employed in several considerable works, which were sent into Spain. The principal among those detained at Naples are, the Martyrdom of St. Jannarius, in the royal chapel; St. Jerome and St. Bruno, in the church of the Trinita delle Monache; and the taking down from the Cross, at the Carthusians.

The subjects he chose for the employment of his pencil are generally of a severe or gloomy nature, and his colouring and execution correspond with their character; being free and bold in style, and dark and strong in hue and arrangement of light and shade. He died in 1656, at the age of 67. He sometimes indulged himself in engraving, and has left about twenty plates of etchings, executed in very much the character of his pictures.

SPAHIS, from the Persian *esparwhee*, q. d. *horseman*, called also *Spaogians*, horsemen in the Ottoman army; chiefly raised in Asia.

The great strength of the grand seignior's army consists in the janizaries, who are the foot, and the spahis, who are the horse. The aga, or commander of the spahis, is called *spahilar agasi*. See AGA.

The spahis are the flower of the Turkish cavalry, and make a part of the grand seignior's guard. They are composed of young men brought up in the seraglio, of soldiers taken from among the janizaries, and others who have distinguished themselves. The spahis are spread over all the towns, and more particularly in the country places; they are almost all married and settled; they exercise different professions, or sometimes apply themselves to the culture of the land; they receive a daily pay, have their appropriate officers, and assemble at the first order, armed and equipped, under the colours of their district. These are a more ancient corps than the janizaries; their pay is greater; and they are understood to be the sons of Mussulmans in a certain degree of affluence; they fight under the same ensigns as the ziamets and timariots, and ought to succeed them in the possession

possession of their fiefs, if the regulations of the first sultans were more respected, or the national interest a little more consulted. Under the first sultans, the spahis formed the principal strength of the Ottoman armies. Almost always in the field, familiarized to military exercises, hardened to the fatigues of war, stimulated by interest, glory, religious fanaticism, and the example of the sultan, it is not surprising that nothing should withstand their arms, and that the modern Greeks, enervated by luxury and riches, solely occupied by intrigues and idle speculations, should be as soon subjugated as conquered. The "Timari-spahis," who are much more numerous, serve in consequence of their possessing a "timar," or fief, on condition of bringing into the field a certain number of men, in proportion to the strength of it. These possessions descend to their children or heirs, when of an age to serve; otherwise, they are given to others, and sometimes, as a recompence, to old soldiers. See **TIMAR**, and **TIMARIOTS**.

SPAUD, or **SPAYD**, a term used by sportsmen for a red male deer three years old.

SPAIN, in *Geography*, a country of Europe, situated between the 36th and 44th degrees of N. lat., and having its western extremity about 9° W. long. from London. Its greatest length from west to east is about 600 miles, and its breadth from north to south is more than 500; so that it forms, if Portugal be included, almost a compact square, and is surrounded on all sides by the sea, except where the Pyrenean range of mountains presents a grand natural barrier against France. The precise western boundary is formed by the river Bidasoa, and the isle of Pheasants is near its mouth. The last town in Spain is Irum, near the Bidasoa. Excluding *Portugal* (which see), the boundaries betwixt these two kingdoms depend more on artificial conventions than on rivers or mountains. The superficial contents of Spain have been estimated at about 148,000 square miles. It lies between the fifth climate on the south, and half-way between the sixth and seventh on the north; the longest days are, therefore, 14½ hours in the southern part, and 15½ in the northern.

The first known division of Spain, into Hispania Citerior and Ulterior, took place under the Romans; but these were soon denominated Lusitania, Bœtica, and Tarraconensis. (See **HISPANIA**.) Lusitania comprehended the eastern part, and extended as far as the Atlantic ocean: its limits were marked on the north by the Duero, on the south by the Guadiana, and from one to the other by a straight line drawn from Simancas to Puente de PArzobispo, and from thence as far as the country of the people called Oretani, in which the town of Almagro at present stands. It included in its extent the towns of Avila, Salamanca, Coria, the territory of Plasencia, Truxillo, Merida and Portugal, the kingdom of Leon, and part of Estremadura. See **LUSITANIA**.

Bœtica was almost surrounded on two of its sides by the Guadiana, bounded on the south by the Mediterranean and the ocean, and terminated on the east by a line drawn from Murgis or Muxacra, a village near the ancient promontory of Charidemus, now called the Cape de Gatte, to the territory of Castulo, which was nearly in the same situation as the modern Cazlona, and to the country of the Oretani. It formed what is called Andalusia, containing the kingdoms of Seville, Jaen, Cordova, and Granada; it also included a part of modern Estremadura, and extended as far as Badajoz, which was within its boundaries. See **BÆTICA**.

Hispania Tarraconensis comprehended all the other parts

of Spain, and was the same with that called Citerior Spain. See **HISPANIA**.

The division of Spain, now stated, underwent some alterations under the last Roman emperors, and was totally changed after the invasion of the northern nations. It was subjected by the Vandals about the year 415, after the Romans had maintained possession of it for about five centuries; and the Visigoths, under Euric, subdued the whole of Spain, excepting Galicia, which was held by the Suevi, who had entered into the country with the Vandals. With this conquest, which occurred A.D. 472, commence the modern kingdom and history of Spain. The Arabs, or Moors, began their conquest A.D. 709, and soon extended it over the whole of Spain, except the mountains of Asturias, where, as well as in Biscay, king Pelagius maintained a limited dominion. The descendants of Pelagius, who fixed the royal residence at Oviedo, which was built in 761, defended their own small territory, and recovered Galicia, and part of Leon and Castile. In the year 914, the kings, as their territory extended towards the south, began to reside at Leon, from which they took their title; and in the 11th century, *viz.* A.D. 1117, that of Castile was added, the kings of Castile having become kings of Leon and the Asturias A.D. 1037. In 1162 the county of Barcelona was transferred to the king of Aragon, whose royalty commenced A.D. 1035. The small kingdom of Navarre, the capital of which was Pampeluno, commenced, as some say, A.D. 857, or, according to others, under Fortunio I. A.D. 880. The reign of Alphonso the Wise began A.D. 1252, and was distinguished by the protection which it afforded to the arts and sciences. Nevertheless, the Moors must be regarded as the chief possessors of Spain, until the middle of the 13th century. Their government in Spain was conducted by governors deputed by the caliphs, until the year 756, when Abdoulrahman seized the sceptre of Spain, and became the Moorish king of Cordova. This dynasty, under which Spain extended its commerce, and acquired very considerable wealth and power, continued until the year 1098, when the caliphate expired, and the Moorish governors of several provinces usurped the royal style, in Cordova, Seville, Valencia, and Granada, and rivalled the small Christian kingdoms, till the middle of the 13th century, when the latter became predominant, and Spain resumed her situation among the states of Christendom. The last of the Moorish royalties which was subdued, was the kingdom of Granada; and the crowns of Castile and Aragon were united in the persons of Isabella and Ferdinand V. A.D. 1474. Charles V. emperor of Germany, having married the heirs of Aragon and Castile, established the Spanish monarchy on its present basis, A.D. 1516; and in consequence of the accession of American wealth, the power of Spain arrived at its zenith. In 1580 Portugal was added to Spain by Philip II., the son of Charles V.; but it revolted under Philip IV. A.D. 1640, and became a separate kingdom. The Austrian dynasty terminated at the death of Charles II., who died without issue, A.D. 1700; and this event was succeeded by the accession of Philip V. of the house of Bourbon.

From the preceding abstract of the principal epochs of Spain, it appears that this kingdom arose from the union of the provinces of the two crowns of Aragon and Castile; the number being four for that of Aragon, and twenty-two for Castile, without including the lordship of Biscay and Navarre. The provinces of the crown of Aragon consist of the kingdom of that name, the kingdom of Valencia, the principality of Catalonia, and the kingdom of Majorca: those

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those of the crown of Castile consist of the kingdom of Galicia, the provinces of Burgos, Leon, Zamora, Salamanca, Estremadura, Palencia, Valladolid, Segovia, Avila, Toro, La Mancha, Murcia, Guadalaxara, Cuença, Jaen, Granada, and Seville. Although this division of Spain is the most ancient, and serves as the basis for the imposition and levying of the taxes, for the municipal laws, and the nature of privileges, the modern division of Spain, with respect to the administration, is limited to thirteen provinces, kingdoms, or lordships, all of which have a captain-general, except Navarre, the intendant of which has the title of viceroy.

The population of Spain consisted originally of Celts from Gaul, and of Moors from Africa; the latter of whom, being more warlike, expelled the former. Towards the east, it received large colonies of Carthaginians, and afterwards of Romans. In the fifth century it was conquered by the Vandals, and next by the Visigoths, from whom several ancient families pretend even now to deduce their origin. The Mahometan Moors were so totally expelled, that they may be considered as almost extinct; and few families of Arabian extract now remain. We may, therefore, regard the modern Spaniards as descended from the African Iberians, the Celtiberian or German Gauls, the Romans, and the Visigoths. The population of this country has varied much at different periods. In the time of Julius Cæsar it has been said, that it contained at one period 40,000,000 of people, and at another period 52,000,000. This estimate, though apparently exaggerated, derives some degree of probability from the consideration of the numerous armies which Spain furnished for a series of years, during the Punic wars, in the time of the Romans and Carthaginians. The population of the towns seems to give us a very high idea of that part of the country in which they were situated. Merida afforded a garrison of 80,000 infantry and 10,000 cavalry; and at the same period, the population of Tarragona amounted to about 2,500,000 inhabitants. The population of Spain sustained but little diminution under the dominion of the Goths; but it very sensibly decreased during the Moorish dynasty, on account of the multitude of victims that fell a sacrifice to the sanguinary sword of the conquerors, and of those who voluntarily exiled themselves, in order to avoid oppression. Spain, however, was again re-peopled by the Christians, who retook from the Moors the lands which they had rapaciously seized. Navarre, which formed a separate state, contained about 800,000 inhabitants; and near the same period, the states dependent upon the crown of Aragon, which constituted the kingdom of that name, with those of Valencia and Catalonia, furnished a very powerful army; and the town of Tarragona alone contained 80,000 families, or 350,000 inhabitants. The kingdom of Granada, subjugated by the Moors, had, at the same era, a numerous population. The city of Granada comprehended 70,000 houses, occupied by 250,000 persons, and furnished 50,000 soldiers. The kingdom, of which it was the capital, reckoned the number of its inhabitants at 3,000,000, on an extent of territory 70 leagues long by 30 in breadth. After the union of the different parts of the Spanish monarchy, in the reign of Ferdinand V. and Isabella, its population is said to have been 20,000,000; but as this estimate is exaggerated, it should be reduced at least one-third. In the year 1688 it amounted to no more than 12,000,000; and on the death of Charles II. and accession of Philip V., in the year 1700, its numbers were reduced to 8,000,000. During the civil wars, which desolated Spain in the first 13 or 14 years of that mo-

narch's reign, it suffered a still greater diminution, so that the population of the whole kingdom could not then have exceeded 6,000,000. Under the pacific reigns of the princes of the Bourbon family, the number of people in Spain greatly increased. The enumeration made by royal mandates, in the years 1767 and 1768, reported the population at 9,307,804 persons; and by a new census, taken in 1788 and 1789, by order of the king, the returns presented 10,061,478. The latest estimate, formed in the year 1797, contains a much higher number, and is said to have exceeded 12,000,000.

The state of the Spanish population, in the year 1788, is exhibited in the following table.

BISCAY.		
Alava	-	71,399
Guipuzcoa	-	120,716
Lordship of Biscay	-	116,042
		308,157
Aragon	-	623,308
Catalonia	-	814,412
Asturias	-	347,776
Galicia	-	1,345,803
Estremadura	-	416,922
ANDALUSIA.		
Kingdom of Seville	-	754,293
Kingdom of Cordova	-	236,016
Kingdom of Granada	-	661,661
Kingdom of Jaen	-	177,136
Sierra Morena	-	7,918
		1,837,024
Kingdom of Murcia	-	337,686
Kingdom of Valencia	-	783,084
Kingdom of Navarre	-	227,322
Mancha	-	206,160
NEW CASTILE.		
Jurisdiction of Cuença	-	266,182
Jurisdiction of Guadalaxara	-	144,370
Jurisdiction of Toledo	-	334,425
Province of Madrid	-	58,943
City of Madrid	-	156,672
Aranjuez, royal demesne	-	2,655
Le Pardo, royal demesne	-	611
		933,865
OLD CASTILE.		
Jurisdiction of Avila	-	115,172
Jurisdiction of Burgos	-	465,410
Jurisdiction of Old Castile	-	74,669
Jurisdiction of Segovia	-	167,525
Jurisdiction of Soria	-	170,565
Jurisdiction of Valladolid	-	196,839
S. Ildefonsa, royal demesne	-	4,331
The Escorial, royal demesne	-	2,453
		1,196,964
KINGDOM OF LEON.		
Jurisdiction of Leon	-	250,134
Jurisdiction of Palencia	-	112,514
Jurisdiction of Salamanca	-	210,380
Jurisdiction of Toro	-	92,404
		665,432
		10,143,975
		According

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According to a statement published at Madrid in 1802, the whole population of Spain appears to be 10,409,879; and those who constitute the different classes as follows:

Men	5,204,187
Women	5,205,692
	10,409,879

Out of this number, the calculation gives

Of single men, religious, and widowers	3,257,022
Of nuns, widows, &c.	3,262,196
	6,519,218
Total	6,519,218
Married persons	3,890,661

As to the proportion between the extent of territory and the number of inhabitants, no estimate sufficiently accurate has ever been made in Spain. For want of a more exact estimate, we shall here subjoin that of Hassel, published at Brunswick, in the "Statistique Européenne," which is supposed to be pretty accurate. According to this, Spain contains 25,145 square leagues, of 25 to a degree, and 10,730,000 inhabitants, which will allow 425 inhabitants for every square league. It will hence be easy to ascertain the other numbers, by calculating after the proportion of 9 to 25. The equatorial degree is 25 French leagues, and 15 German miles; then reckoning their surfaces as the squares of their sides, 9 square German miles are equal to 25 square leagues of France.

	Square German miles.	Inhabitants in general.	Inhabitants by square Miles.
The whole of Spain	9053	10,730,000	1185
Kingdom of Castile	6628	7,278,000	1098
Provinces of Madrid, Toledo, Guadalaxara, Cuenca, and La Mancha	1731	1,162,000	602
Burgos, Segovia, Soria, and Avila	740	915,000	1236
Leon, Valencia, Toro, Zamora, Valladolid, and Salamanca	805	939,000	1042
Asturias	240	348,000	1450
Galicia	640	1,350,000	2109
Estremadura	682	427,000	527
Seville	424	755,000	1780
Cordova	296	237,000	800
Jaen	240	118,000	491
Granada and Antiquera	580	686,000	1184
Murcia	250	360,000	1440
Kingdom of Aragon	2145	3,152,000	1469
Aragon	710	624,000	878
Navarre	180	190,000	1055
Catalonia	580	1,200,000	2068
Valencia	490	933,000	1904
Majorca	185	205,000	1105
Lordship of Biscay, comprising Alava, Guipuzcoa, and Biscay	280	300,000	1071

Others have stated the population of Spain at 11,000,000, and allow 74 persons to a square mile. Of its ancient po-

pulation, numerous vestiges exist in various parts of the country. And among the causes of its depopulation we may reckon the contagious fevers frequent in the southern provinces, incessant intestine wars, the emigrations to America, the invasion of the country by the Moors, the want of encouragement to agriculture, the multitude of detached farms, the effect of the *mesta*, (which see,) or wandering flocks, the number of unmarried clergy and monks, and, more especially, that fanatic and mistaken zeal, which proscribed, on account of their religious tenets, two classes of wealthy and industrious people, the Jews and the Moors. These were peculiarly valuable, on account of their intimate acquaintance with agriculture, arts, trade, and commerce. An edict issued at Granada, March 30, 1492, against the advice of the ministry, and many members of the supreme council, ordained, that every Jew who did not profess Christianity within six months, should be constrained to quit all countries under the government of the Catholic kings. Another equally impolitic edict was published in the year 1614, by which numbers of Moors, who, after having been subdued, had remained peaceably in Spain, were expelled the country. About 100,000 Jewish families pretended to be converted, and in the issue became victims to the inquisition. More than 800,000 Jews left the kingdom, and migrated to France, Italy, Africa, and the Levant, and carried with them the wealth and other species of property which they had acquired by industry and trade. All the Moors, to the amount of 2,000,000, departed, leaving their towns and villages deserted. We might add, as another collateral cause of the depopulation of Spain, the depredatory cruising of the Barbary pirates, for the space of 300 years, by which they made numerous captives, both at sea and by incursions on the coasts.

Towards the end of the 8th, and commencement of the 9th century, Spain was inhabited by four principal nations; viz. the natives, then known by the name of Romans; the Goths, comprehending the remains of the Suevi, Alani, and Vandals, several of whom were confounded with the natives and Moors, though a considerable part had taken refuge in the Asturias and Navarre; the Moors, with whom the natives of Africa were mingled; and the French, who occupied a great part of Catalonia, Navarre, and the Pyrenees. Each of these nations brought with it its own genius, manners, laws, and customs; and besides, the expulsion of the Moors from Spain was succeeded by the formation of several independent sovereignties, each of which had its own laws and particular form of government. Hence resulted a diversity of genius, temper, manners and customs; which, though in some degree modified by the present uniformity of government, still subsists; so that there are no two provinces exactly resembling each other in manners and character. Some customs, however, and some traits of character, correspond to one another in all the provinces. The national pride is every where the same, and this the Spaniard energetically expresses by his gestures, words, and actions. In many cases this is the pride of virtue, or a natural dignity of sentiment, which soars above vice and folly. With this pride, which is discernible in all ranks of life, and in all classes of society, the Spaniards combine, in a very eminent degree, temperance and valour. Of their valour in more remote ages, Thucydides, Diodorus Siculus, Livy, Strabo, and Lucius Florus, furnish a variety of instances; nor have they altogether lost this distinguishing quality of their ancestors. In this respect, some shades of difference have been observed among the military of different provinces. The Galicians are accounted the best soldiers in Spain. Strabo has said of them, that they were warlike, and that it was difficult to subjugate

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subjugate them. The valour of the Catalonian is said to be the most intrepid; that of the Aragonese the most considerate; that of the Andalusian the most presumptuous; that of the Castilian the coolest; and that of the Biscayan more active amongst rocks than on the plain. The Spaniards are reckoned to be, in general, very grave and reserved; and in their address, cold and repulsive; but blended with their gravity, they manifest a degree of gaiety, particularly since the accession of the house of Bourbon, which is frank and lively. Notwithstanding this occasional vivacity, the Spaniard is very tardy and slow in all his operations, respecting not only business and politics, arts and sciences, but even their amours and pleasures. That indolence and hatred of labour which prevail in their national character, have produced an aversion for agriculture and commerce, the effects of which have been nationally injurious. It has been observed, however, that this kind of apathy and indisposition to labour, solely, or principally, prevail in those parts where industry is without a spur, activity without an object, and commodities without a vent. The provinces near the sea are all industrious; the inland provinces, destitute of canals and navigable rivers, and, till of late, of roads, and possessing no cheap or easy mode of communication, have no means of supporting industry.

The Spaniards were formerly very jealous of their wives and mistresses; the women were shut up in their own houses as in a kind of prison, where thick lattices concealed them from the observation of impertinent curiosity. They received few visits in the apartments to which they were confined, and which no man could enter without great difficulty and many precautions. They were placed under the guardianship of one or more duennas, and could not take a single step, either in their own houses or abroad, which was not subject to their inspection. Whenever they went out, a veil concealed the face from every passenger.

Times are greatly altered; husbands are now much less suspicious—more reasonable, or more easy—and women much more accessible. Lattices and jealousy have disappeared; duennas only exist in romances; veils, under the name of *mantelas*, have become an ornament which gives effect to beauty; all houses are thrown open; the men, gallant and amorous as ever, are become less captious; the women have recovered a liberty by which they are, perhaps, less tempted to go astray than formerly, when their virtue was entrusted to locks and grates, and to a superintendance often faithless, and easy to be corrupted.

Both the men and women have gained by the change; the former have become less morose, more frank and agreeable; the women more attractively disclose the many easy graces with which they were endowed by nature.

Several of the games, diversions, and public spectacles of the Spaniards, are derived from the Moors, and to the same origin we may trace many of their customs, and even that kind of dress and mode of living which were long prevalent in this country. After the expulsion of the Moors, the Goths and native Spaniards, blended together and forming one nation, adopted the same costume and manners. On the accession of Philip V. the Spanish habit was neglected and disused, and the French, which still prevails, substituted for it. The Spaniards are now as luxurious in their dress as they were formerly simple; they make use of the richest stuffs and silks, as well as of embroidery in silk, gold, and silver. The most varied and conspicuous colours have succeeded to black, which was, for several centuries, the national costume. The common people, however, in several of the provinces, retain their ancient mode of clothing, with some diversity in different parts of the country. Different

professions have their peculiar costume in Spain. Uniforms are very numerous, and are not confined to the military. The Spanish nobility have an uniform for the holy week; they wear it at court and in town, and the king and royal family wear the same. The coat is of black velvet, lined with crimson satin, with gold, or gold embroidered buttons, and facings of gold brocade on a crimson ground, or of satin of the same colour embroidered with gold. The waistcoat is the same as the facings, and the breeches are black. This dress is handsome and dignified. Among the amusements of the Spaniards we may reckon the festivals of the church, which in several of the provinces, particularly in Aragon, are attended with very brilliant and magnificent decorations; the fire-works, which are very common in Spain; the masquerades, which were formerly much in fashion in Spain during the carnival, particularly in Aragon; and the bull-fights, which were the true national spectacle; but this amusement was suppressed several years ago. The amusements of people of rank chiefly consist in dancing and cards; and the theatre is much frequented, though the plays and music do not correspond in excellence with the national refinement.

The origin of nobility in Spain cannot be precisely ascertained. Of this order of persons no traces appear, whilst the country continued under the dominion first of the Carthaginians, and afterwards of the Romans. The rudiments of it first manifested themselves under the Gothic kings; but it was almost totally annihilated by the Saracenic invasion. After the expulsion of the Moors, a regular order of nobility began to grow up in the newly established kingdoms of Spain, with peculiar modifications in different states. The only method of acquiring nobility in this country is by a royal grant, as it is not attached to the exercise of any office, civil or military: and the price of a patent of nobility varies in the different provinces. Of late years a distinction has been taking place, between the titled and untitled nobility. The former are so called because they have obtained from the king the title of grandee, of duke, of count, of marquis, or of viscount. These titles of nobility are hereditary in the families of those to whom they have been granted, and descend first to the males, according to seniority, and then to the females, who have a right to transfer them to their husbands and to their children. The titled nobility, unless they have been advanced to the dignity of grandee, enjoy few privileges above those that are entitled. The grandees, of whom there are several classes, are at the head of the Spanish nobility, and at court take precedence of all secular dignities, except those of constable and admiral of Castile. The most valued privilege belonging to the grandees is that of being covered in the royal presence. The number of titled nobility in the year 1787 was as follows; 129 grandees, 535 marquises, counts, and viscounts; of these latter, 142 habitually resided at court, and the rest in the provinces.

The military orders in Spain were formerly eleven, all of which are become extinct. At present there are seven different orders, *viz.* those of the Golden Fleece, of San Jago, or St. James of the Sword, of Calatrava, of Alcantara, of Montesa, of Charles III., and of Maria Louisa. Of these, the first has passed by succession to the Spanish crown, the four next are the military orders properly so called, and the two last are of modern institution. (See *GOLDEN FLEECE*, *St. JAMES of the Sword*, *CALATRAVA*, *ALCANTARA*, *St. GEORGE of Alfama*.) For the four last named military orders the qualifications at present necessary are eight years of active service in the Spanish army, and proofs of nobility of four degrees, on the side of both father and mother. The only

only advantage that accrues of necessity, on admission into any of these four orders, is the honour of wearing the cross, besides a few unimportant privileges: the commanderies are places of pecuniary profit, belonging to those who have taken the vow of combating the infidels, of fidelity towards the sovereign, and, of conjugal charity. The order of Calatrava has 20 of these, valued at 71,250*l.* sterling; that of San Jago has 87, valued at 81,250*l.*; that of Alcantara has 37, worth 39,000*l.*; and that of Montesa 13, at 12,588*l.* To each of the orders belong monks, and several convents of nuns. The order of Charles III. was founded by the king of that name, on the 19th of September, 1771, and placed under the immediate protection of the Holy Virgin, under the title of the Conception. Of this order the sovereign is chief; he alone nominates the grand crosses and knights. The order is composed of sixty grand crosses, two hundred pensioned knights, and an indefinite number of others; of a grand chancellor and minister, who is always the patriarch of the Indies; of a secretary, a master of the ceremonies, and a treasurer.

The cross of this order is of eight points, surmounted by a royal crown, with a figure of the conception in the middle; it is worn hung to a ribband of three equal stripes, the two outer of which are blue, and the inner white. The grand crosses wear this ribband much broader than the knights, faldierwise from the right shoulder to beneath the left arm, with a conception of silver embroidery on the left side of the habit and cloak. On days of ceremony they wear a long cloak, and a collar, the links of which are formed alternately of the king's cypher and the arms of Castile. The knights wear the cross hung from the button-hole by a narrow ribband. The pensions of the knights (of which there are 200) are each fixed at the sum of 4000 reals: they are given to military men, to men of letters, to lawyers, to gentlemen, and to those employed in the ministerial departments. This order has a supreme council, composed of the sovereign, of the grand chancellor of the order, who is also vice-president, of a secretary, a fiscal, an accountant, and ten counsellors.

The order of Maria Louisa is very modern, having been established in 1792, by Charles VI., who named it after the queen his wife. Only ladies are admitted into this order. The grand-mastership is vested in the queen, and the number of ladies is thirty. The cross of the order is a medallion, with a portrait of the queen, hung to a violet ribband, divided in the middle by a white stripe, and worn faldierwise.

In Spain there is a description of persons denominated "Mayorazgos." The term, derived from the word *mayor*, or first-born, implies, strictly speaking, the right possessed by the eldest-born of a family, to inherit certain property, on the condition of transmitting it entire and undiminished to those who may be possessed of the same right on his decease.

The import of this term has, however, been much extended by use; for, though it properly means only the right of succession to a perpetually entailed estate, in virtue of primogeniture, yet it now signifies, in addition, the cause which produces the right, the property which is the object of it, the actual possessor of the property, and the person who stands next in succession.

Of these mayorazgos there are five classes or kinds, distinguished by certain circumstances incident to the descent or transfer of property. Many disadvantages have attended the extensive multiplication of mayorazgos; especially when the succession descends to females. Instead of perpetuating families, for which purpose the institution was intended, it very much contributes to their extinction; it injures the ge-

neral progress of agriculture, and it encourages idleness, to which the Spaniards are very much addicted.

Literature, Sciences, the Arts, and Language.—The state of science in Spain, before the time of the Romans and Carthaginians, is wholly unknown; but when the Romans introduced with their arms the arts of civilization, the Spaniards began to cultivate literature and the sciences, and produced several writers who attracted distinguished notice: such were L. A. Seneca, a native of Cordova; the geographer M. Pomponius Mela, of Andalusia; and J. M. Columella, of Cadiz, whose works on agriculture and rural economy are even now held in high estimation. Under the Goths, when literature was restrained and oppressed, Spain furnished persons no less distinguished by their virtues than by their talents and writings. To this class we may refer Hosius, bishop of Cordova; Gregorius Boeticus, bishop of Elvira; S. Ildefonso, archbishop of his native place, Toledo; S. Isidore, a native, and afterwards archbishop, of Seville; Priscillianus of Galicia; Petrus of Saragossa, a distinguished orator; Aurelius Prudentius, of Calahorra, an esteemed poet; and Aquilius Severus, who wrote an account of his travels in Africa. The invasion of the Moors introduced a period of barbarism; but at this time we find, without mentioning persons of less note, king Alphonso IV. of Castile and X. of Leon, who was celebrated for his acquirements in various departments of literature and science; who was a legislator, orator, historian, poet, mathematician, and astronomer; and who merited the appellation of "El Sabio," the sage, which was conferred upon him by general consent. Although the native Spaniards were plunged in ignorance, the Moors united with the most romantic bravery, a passionate love of science and the arts. Besides their theatres, public shows, and tournaments, they established public schools in every town under their dominion, of which those of Seville, Cordova, and Granada, obtained a high degree of reputation. They established in various places colleges and academies, as well as libraries, for the promotion of science and literature. The sciences cultivated by them with eminent success were, geography, experimental philosophy, optics, botany, chemistry, medicine, natural history, geometry, and other branches of the mathematics. When the Moors were expelled, the fortunate and brilliant reign of the Catholic sovereigns Ferdinand and Isabella was the era in which knowledge revived, and its boundaries were enlarged during the reigns of Charles V. and Philip II. During the inauspicious period that succeeded the reign of Philip II., several persons of distinguished genius and attainments exerted themselves for the protection and encouragement of science; and it would be tedious to mention even the names of those who excelled in various branches of learning. We cannot, however, forbear mentioning Benedict Feyjoo, a Benedictine monk, who died at Oviedo in 1762, and who did honour to his country at a time when literature, science, and the arts, were almost wholly neglected and unknown. To him Spain was indebted for the restoration of literature, good taste, and the love of study. We might also enumerate among its distinguished poets and historians, Quevedo, Cervantes, Saavedra, Lopez de Vega, Guevara, Mariana, Granada, Solis, Herrera, &c.

The number of universities, or rather academies, in Spain, was formerly twenty-four, but the following seventeen are all which now remain, *viz.* that of Pampeluna, in Navarre; of Oviedo, in the Asturias; of San Jago, in Galicia; of Seville, and of Granada, in the provinces of the same name; of Huesca and Saragossa, in Aragon; of Avila, Osma, and Valladolid, in Old Castile; of Toledo, Sigüenza, and Alcalá de Hamarez, in New Castile; of Cervera, in Catalonia;

lonia; of Orihuela and Valencia, in Valencia; and of Salamanca, in the province of Leon. Several of these scarcely deserve notice. Those of Saragossa, Alcala, and Cervera, retain some degree of importance; but the most ancient and most celebrated is that of Salamanca; for an account of which see that article. The most popular university at present is said to be that of Valencia. The conventual schools are numerous; and Spain has four military schools, *viz.* at Barcelona, Zamora, Cadiz, and Segovia. Public libraries are also numerous.

The native tongue of the ancient Spaniards was utterly lost during the domination of the Romans, whose language in the corrupt form of the middle ages became that of Spain. The Goths brought into the country their own Teutonic dialect; and as the natives continued to speak Latin, their language became at length a mixture of Latin and Teutonic. The Arabs, in their turn, introduced the speech of their country, vestiges of which remained after their expulsion. Hence it appears, that the Spanish language was compounded from three different sources: the Latin prevailed over the other two, and the Gothic still preponderates over the Moorish. Within the last two or three centuries the Spanish language has undergone considerable alterations; it still, however, preserves the same roots, the same turn of phrase, and the greater number of its words, but altered in their inflections and terminations. The Spaniards themselves boast, among other excellencies, of the facility with which it is pronounced; it is founded, they say, exactly as it is written, but this assertion is too general. In some respects this language is very rich; it abounds in compound words, in superlatives, derivatives, augmentatives, diminutives, and frequentative verbs; it has many quite synonymous words, and others which well express the different shades of meaning. In the technical terms of arts and sciences, it is, however, extremely poor; a few of these it has borrowed from the Latin, and almost all the rest from the French.

On the whole, the Spanish is one of the finest of the European languages. It is dignified, harmonious, energetic, and expressive; and abounds in grand and sonorous expressions, which unite into measured periods, whose cadence is very agreeable to the ear. It is a language well adapted to poetry, but it also inclines to exaggeration, and its vehemence easily degenerates into bombast. Though naturally grave, it easily admits of pleasantries. In the mouth of well educated men it is noble and expressive; lively and pointed in that of the common people; sweet, seductive, and persuasive when uttered by a female. Amongst the orators it is touching and imposing, though rather diffuse; at the bar and in the schools it is barbarous; and is spoken by those about the court in a concise and agreeable manner.

The Spaniards articulate strongly, and sometimes with a kind of guttural sound, which greatly impairs the grace and dignity of their speech, but the pronunciation differs materially in different provinces. In Catalonia it is harsh and constrained; harsh also and dry in Aragon; quick and lively in Biscay; agreeably modified in the kingdom of Valencia; boastful and mouthy in Andalusia; softer, sweeter, and more natural in Castile.

The Spanish language is not spoken with the same purity in all parts of the kingdom. Besides the old provincial dialects, which still prevail in many parts, the Basque is still spoken in Biscay; and the language is mixed with French in Navarre, with Portuguese in Galicia, and with Arabic in Murcia and Andalusia. It is in New Castile, and especially in the ancient kingdom of Toledo, that it is best spoken; and there that a stranger ought to learn it

who desires to become acquainted with all its delicacies and beauties. The ancient Limoufine or Provençale forms the basis of the dialects of Catalonia and Valencia.

Basque is spoken in the lordship of Biscay, in Guipuscoa, and in the greatest part of Alava. This language is very ancient; it differs entirely from the Spanish, either ancient or modern; it existed before the arrival of the Romans, and was then unlike what was spoken in the other parts of Spain; it is mentioned by Strabo, Seneca, and Pomponius Mela. It has been preserved to our days almost without alteration or corruption, particularly in the more mountainous parts. It is very difficult to strangers, and appears to those who do not understand it a coarse and barbarous tongue, destitute of elegance and expression; but such as are versed in it account it very sweet and expressive.

The Spaniards, abhorring the Moors, disdained to apply themselves to the arts which they exercised; and hence proceeded a general contempt for artificans, which has been perpetuated to the present time, and has greatly retarded their progress in Spain. The arts which are employed in manufactures are much advanced in Spain. The 16th century was the most brilliant period of the arts in Spain, as well as of the sciences, of literature, and of the power and grandeur of the monarchy. Many able architects appeared at once under Charles V. and Philip II., who erected numerous edifices, that will immortalize the reigns of those princes and the names of the artists, such as John de Herrera, Cepedes, Pedro de Uria, and John Baptist Monegro of Toledo, the latter of whom assisted in the building of the Escorial, and of the church of St. Peter at Rome. The structures of this age are the finest in Spain. Architecture, however, very much declined in the 17th century; but about half a century ago it began again to be cultivated with success. Spain justly boasts of a number of sculptors of distinguished merit, among whom we might mention Paul Cepedes of Cordova, and Alonzo Cano of Granada. Of all the liberal arts, painting is that which has been most cultivated in Spain; and though the Spanish school is little known, it deserves notice, as occupying a middle place between the Italian and Flemish schools, being more natural than the first, more noble than the second, and participating the beauties of both. It has particularly excelled in sacred subjects. Most of the painters of Spain are of the 17th or the end of the 16th century. In the 18th century painting was almost totally annihilated in Spain; but the Spanish school was recovered about the middle of the same century by Antonio Raphael Mengs. Spain now possesses an academy of painting at Seville, and two academies of the fine arts, one at Madrid, and the other at Valencia; and public, gratuitous schools for drawing have not long ago been established in various places. The Spaniards have a taste for music, and have cultivated it with success. They prefer the Italian to the French music, the latter being in their opinion too languid and monotonous. The Moors were the first in Spain who cultivated music scientifically, and who established schools for teaching it; and the Spaniards have been led to imitate them. The Moorish music consisted chiefly of soft and tender airs, sung by one or more voices, and accompanied by the lute; and the modern Spaniards have also their national music, resembling that of the Moors, and confined to detached airs, which are sung by one or more voices, and accompanied by the guitar. Spain has also adopted the musical instruments generally used among other nations, and it has some that are peculiarly its own. Different provinces have their appropriate instruments. For the history of Spanish music, see the sequel.

We have already mentioned dancing as one of the amusements

ments to which the Spaniards are much addicted. Besides those dances which are provincial, they have three which are national; *viz.* the fandango, the bolero, and the seguidilla. The fandango is very ancient; it is probably referred to by Martial, and it is defined by Baretto to be a regular and harmonious convulsion of all parts of the body. The bolero, which is quite modern, is an imitation of the former, but shortened and modified, and stripped of all those accessories, which give to the fandango so very free a character. The seguidilla is an imitation of the steps of the two others formed into a ballet. These dances are usually performed to the sound of the guitar, accompanied by the voice of the player. The women very correctly mark the time with the heel, a motion which adds a new grace.

Climate, Soil, and Agriculture.—The climate of Spain is equal, if not superior, to that of any country in Europe; it is in general very dry, and irrigation is rendered difficult by the chains of mountains that intersect it. The climate is various in different provinces, and in those that lie to the south the heat is insalubrious, and sometimes occasions epidemic diseases that are very fatal. These are partly owing to stagnant and undrained marshes, and to the neglect of proper culture. The chains of mountains that intersect the country at various distances from E. to W. serve to temper the climate, and supply cooling breezes. In the south the sea-breeze, commencing about nine in the morning, and continuing till five in the afternoon, moderates the heat of summer: and the severity of winter in the northern provinces is allayed by the gales of the ocean, at no great distance. It has been observed, that the temperature of Spain is influenced by its peculiar configuration, and by the singular height of this country above the level of the sea, inasmuch, that although from the N.E. it gradually becomes lower, yet the high plain, or table land of the Castiles, has an elevation of upwards of 300 fathoms. According to the observations of Humboldt, the interior of Spain is an elevated plain, and the highest of any of the same kind in Europe, which occupies a large extent of country. The mean height of the barometer at Madrid, observed by Don Felipe Bauza, shews that capital to be elevated at 309 $\frac{1}{2}$ fathoms above the level of the ocean, allowing the barometer on the coasts to be at 338 and 24 lines. Hence it appears that the elevation of Madrid is 15 times greater than that of Paris, three times greater than that of mount Valerian, and also three times greater than that of Geneva, which is 188 fathoms above the level of the sea. This height of the plain of the Castiles has an obvious effect upon its temperature. The mean temperature of Madrid appears to be 59° of Fahrenheit, while that of Petersburg is 39° 52' 30"; that of Berlin, 46° 57' 30"; that of Paris, 53° 56' 15"; that of Marseilles, 58° 33'; that of Toulon, 61° 15'; that of Naples, 63° 30'; and that of the countries situated under the equator and on the level of the ocean, from 70° to 81°. Genoa is four degrees more to the north than Madrid, and yet the temperature of Genoa raises the glass almost two degrees higher than that of the capital of Spain. Such is the influence of local causes, of the elevation of scite, the proximity to the sea, a chain of mountains which keeps off the cold northerly winds, and a great number of little circumstances, the combination of which moderates the temperature of places.

If the mean temperature of the elevated plains of Spain is 59° of Fahrenheit, that of the coasts from the 41st degree of latitude to the 36th, is between 63 $\frac{1}{2}$ ° and 68° Fahrenheit. Thus we see banana-trees, heliconias, and fugar-

canes, growing upon these coasts in situations that are sheltered from the cold winds.

Upon the whole, the face of the country is in most seasons delightful, abounding with excellent and fruitful pasturage, vineyards, and groves of orange-trees; and the hills stocked with wild thyme and other odoriferous plants. The rivers and streams are numerous; and the chains of mountains afford a great variety to the prospect. The most northern of these chains is regarded as a continuation of the Pyrenees, passing on the S. of Biscay and the Asturias into Galicia; and it is variously denominated, as the mountains of Biscay, the Sierra of Asturias, and the mountains of Mondonedo in Galicia. It is also known by the names of the mountains of Santillana, of Vindo, and of the mountains of Oea. We here observe that the term "Sierra," peculiar to Spain, denotes a chain of mountains, the successive peaks of which present the resemblance of a *saw*. The gypseous and argillaceous mountains of this country rarely exhibiting any supreme elevation, like those in the granitic chains, naturally suggested this appellation. The second chain of Spanish mountains extends from near Soria on the N.E., and pursues a S.W. direction towards Portugal. This chain is called that of Urbia, or Guadarama, and also the Montes Carpentanos. The third is that of Toledo, or Guadalupe, running nearly parallel with the last. These two central chains seem to contain great quantities of granite. Next towards the S. is the Sierra Morena, or brown mountains, which are followed by the most southern ridge, that of the Sierra Nevada. On the E. there is a considerable chain, which connects the two central ridges, and advances towards the Mediterranean in the N. of Valencia. There are also considerable ranges of hills in this part of the kingdom, generally running from N. to S. Near Barcelona is a remarkable solitary mountain, at a distance appearing like a fugar-loaf, and on a nearer approach jagged like a saw, with pyramidal rocks; composed of facillite or pudding-stone, formed of limestone gravel united by calcareous cement; and so high, that from its summit may be seen the islands of Majorca and Minorca, at the distance of 50 leagues. The circumjacent region consists of argillaceous schistus, with clay and sand. Not far from this mountain, called Montserrat, near the village of Cardona, is a hill three miles in circumference, which is a mass of rock-salt, used in the dry climate of Spain for vases, snuff-boxes, and trinkets, like our Derbyshire spar.

According to the description of the ingenious observer, Mr. Townsend, the northern side of the Pyrenees (which see) is chiefly calcareous, surmounted with argillaceous schistus; but the southern is granite, and of course barren. The hills to the S. of Gerona are also granitic. The highest ridge in Spain, near Daroca, from which originate the Tajo and the Ebro, seems to be composed of argillaceous schistus, and free-stone, probably resting on granite. Near Achnuala the mountains are limestone with shells, and in some places contain beds of red gypsum, with crystals of the same colour. In general, gypsum is as abundant in Spain as chalk is in England; and the gypsum produces crystals of sea-salt and Epsom salt, and abundance of nitre. The mountains on the N. of Madrid, forming part of the central chain, are granite. Those to the N. of Leon are chiefly marble or limestone, on a basis of argillaceous schistus, rising in bold and rugged rocks, which afforded a barrier to the remains of Spanish liberty. In returning towards the S. the soil of La Mancha is sandy, the rock gypsum. The higher regions of the Sierra Morena are granite: the lower, argillaceous schistus with gypsum and limestone. The granite is of two kinds, the red and the white. Near Cordova the highest hills

are covered with rounded masses of granite, grit, and limestone. Near Malaga are branches of the Sierra Nevada, or snowy chain, an appellation which might be extended to the central range between Old and New Castile, which, according to Mr. Townsend, may at some times be visible at the distance of 100 miles: these branches present limestone and marble, surmounted by argillaceous schistus. Near Alhama, S.E. of the city of Granada, are found rocks, which, on a basis of shingle or round gravel, present sand-stone with shells, surmounted with facelite; but in general the rocks are gypseous, with strata of the same substance crystallized. Mr. Townsend supposes that the power of the sun contributes to impregnate chalk with vitriolic acid, thus forming gypsum. The S.E. part of Spain seems to be equally calcareous, and the cathedral of Murcia is built with pisolite, a sort of free-stone, resembling the roe of fish. The aventurine is found in the mountain of Gata, towards the frontiers of Portugal; the Cape de Gata presents also some singularities, and appears to some travellers to have been volcanic.

The forests, or rather chaces of Spain, are numerous. They are little cultivated, and are partly reserved for the pleasures of hunting; such is that of the Pardo, which is barren of trees, and extends about 30 miles. Some of the forests are haunted by smugglers and banditti, who rob travellers, and often commit murders.

Spain, including the whole country S. of the Pyrenees, in relation to botany, and its vegetable productions, has been divided into the sea-shore, the high mountains, the lower ones, the arable lands, the grazing tracts and marshes along the rivers, and the vicinity of Lisbon and Oporto. The sea-shore, with respect to its vegetables, resembles for the most part the northern coasts of the Mediterranean; the flat sandy tracts being occupied by the sea-daffodil, the shrubby glass-wort, and the *salvia fida* and *fativa*; and of the latter there are extensive plantations in the vicinity of Alicante and Barcelona, the ashes of which yield the barilla, of which some thousand tons are annually manufactured: the rocks on the coast are chiefly calcareous, and abound with several vegetables, and particularly with the *stipa tenacissima*, or esparto grass, used in making ropes, mats, chair-bottoms, &c. The high mountains of Spain are covered with snow only for a few weeks in the year, and in these elevated regions are found the finest timber trees, and other vegetable productions of the same kind with those that are met with in the north of Europe. The long ranges of hills that occupy the greatest part of Spain, consist either of extensive arid tracts of sand, arenaceous sand-stone, and ferruginous rubble forming the heaths, of dry calcareous districts forming the sheep-walks, or of moist rough granitic and marble ridges, with a shallow soil, forming the woodlands. The Spanish heaths are gayer and richer with plants than those of any other European country. The sheep-walks are for the most part open downs, with little shelter, excepting occasionally groves of chestnut-trees or evergreen oaks. In the wood-lands the trees are neither so large nor so ample in their foliage as those of the German and English forests. The maritime provinces of Spain abound with wood; but in the interior provinces trees are rare, and plantations are not sufficiently encouraged. Portugal and Spain are deficient in respect of water; the rivers flow through rocky channels, and therefore the marshes and bogs are infrequent. The vicinity of Lisbon and Oporto, and of a few other towns on the coast, afford a number of Indian, African, and American plants.

In zoology, Spain is celebrated for its horses and mules,

the latter however being more regarded than the former, which are said to degenerate, and particularly for its sheep, which are superior to those of other countries with respect to the delicacy of the mutton and the beauty of the fleece.

In mineralogy, Spain was formerly more distinguished than it has been in later times. Pliny, Strabo, and Polybius, speak in high terms of commendation of its precious metals; so that Britain and other maritime regions received their gold and silver from Gaul and Spain, in return for cattle, hides, and other products. At present the silver-mines are almost wholly confined to Guadalecanal in the Sierra Morena, though rich veins of the same metal, in a fuliginous state, exist in many places. The quicksilver mines of Almadan in La Mancha furnish America with mercury for refining its more precious metals. Calamine, cobalt, antimony, copper, tin, and lead, are found in Spain; its iron is valuable; and coals are obtained in the district of Villa Franca, in Catalonia, where also occur gold, silver, copper, and lead. Amber and jet are found in the territory of Betonica, in the Asturias. The other minerals it is needless to enumerate. Murcia produces a fine red earth, called "almagra," which is mingled with the Spanish snuff. The aventurine of Spain is a felspar sprinkled with golden mica.

Few of the mineral waters of Spain are much celebrated. The hot springs near Oviedo resemble those of Bath; and those near Alicante are warm springs of a chalybeate nature, rising like the fumes among calcareous hills.

We shall now advert to the *agriculture* of Spain. The soil in Spain is generally light, and reposes on beds of gypsum; nor is any country in Europe upon the whole so fertile as this, or possessing equal advantages at all seasons of the year. It was, indeed, in this region that the ancients fixed the seats of the Elysian fields, and the gardens of the Hesperides. When the Romans first entered Iberia, they were astonished at the productive and flourishing state in which many parts of it were found; and they encouraged the existing industry, so that Spain became the granary of their empire, and the nursery of their armies. The northern nations, when they took possession of the country, parcelled out the lands, and turned their attention to the improvement of agriculture. They constructed subterraneous buildings, or granaries, in use before their time, for the preservation of corn, and encouraged the formation of canals and sluices, for the irrigation of the land. Under the Moors agriculture was in a still more flourishing state; and the era of their expulsion designates the epoch of the decline of agriculture. The Spaniards, deprived of their assistance, possessed neither talents, activity, nor persevering industry, for the cultivation of their lands; and though they had an excellent soil, and numerous rivers to counteract its aridity, and nothing but industry and labour were wanting, scarcely two-thirds of the country were under cultivation: so that they have been under a necessity of importing a large quantity of corn from foreign countries. Many attempts were made by successive Spanish monarchs to rouse the spirit and invigorate the system of agriculture; but they proved, from various impeding causes, in a great degree ineffectual. A variety of circumstances contribute to diminish the number of persons that are inclined to labour, as well as to contract the portion of time that may be employed for this purpose. Although Spain has a population of 10,143,965 persons, yet of these, the women, children, and old and infirm men, constitute five-eighths of the whole, and reduce the population to about 3,803,981 men. From this number must be subtracted the secular and regular clergy, military and navy, nobility, students, counsellors, scribes, domestics, and tax-

SPAIN.

tax-gatherers, amounting to 1,221,799 persons; so that the number of those who might be actively employed in agriculture, subject to a still further reduction, amounts to considerably less than 2,582,592. The number of working days is much lessened by the multiplicity of feasts and holidays. The want of good roads and of convenient markets, the high price of labour, and the "melta" (which see), very much impede agricultural improvement. Under all these disadvantages, so fertile is the soil and so favourable the climate, Spain produces a very considerable quantity of various sorts of grain; but different provinces are more or less distinguished in this respect. Flax, hemp, sugar-canes, madder, foda, saffron, broom, honey, palms and dates, cork-trees, kermes or gall-insects, and different kinds of fruit, almonds, nuts, figs, carob-beans, olives, vines and dried raisins, may be reckoned amongst its productions. The common course of husbandry about Barcelona, as Mr. Townsend informs us, begins with wheat; which being ripe in June is immediately succeeded by Indian corn, hemp, millet, cabbage, kidney-beans, or lettuce. In the second year these crops succeed one another as before. In the next year they sow barley, beans, or vetches, which being taken off the ground before Midsummer, are followed, as in the former year, by other crops, changing them according to the season, so as to have on the same spot the greatest variety. Wheat produces a ten-fold crop, and in rainy seasons fifteen for one. Near Carthagena, the course is wheat, barley, and fallow. For wheat they plough thrice, and sow from the middle of November to the beginning of December; in July they reap from 10 to 100 for one, as the season happens to be humid. The Huerta, or rich vale of Alicant, yields a perpetual succession of crops. Barley is sown in September, reaped in April; succeeded by maize, reaped in September, and by a mixed crop of esculents which follow. Wheat is sown in November, and reaped in June; flax in September, pulled in May. In the vale of Valencia wheat yields from 20 to 40; barley, from 18 to 24; oats, from 20 to 30; maize, 100; rice, 40. In the more southern provinces, the land is almost equally fertile: and the sugar-cane is successfully cultivated near Granada. The Spanish plough is generally light, and is drawn by oxen with the yoke over the horns. All the provinces of Spain produce wine. The eastern and southern provinces contain a vast number of vines; but the northern and western not so many. But the wines vary in respect of quality in the different provinces, and in the several districts even of the same province. The ordinary wines of the country are red wines; but many districts of Spain produce excellent sweet wines. The old sherry wine, "Xerez seco," is the sherry sack of Shakspeare. The dried grapes or raisins form in the kingdom of Valencia, where they annually produce 88,461½ cwt. and usually export 36,538 cwt., and particularly in that of Granada, the environs of Malaga furnishing annually 288,461½ cwt. and exporting 240,577 cwt., a very considerable article of commerce. In the latter province, they are simply dried in the sun, without any other preparation; in the former the grapes are steeped in boiling water, sharpened with a ley made of vine-stems, and then exposed to the air and suspended in the sun, till they are sufficiently dry. Those of Malaga are of a superior quality, in greater estimation, and obtain a higher price than any other. They are naturally larger, and of a more delicate flavour than any others. The cultivation of sugar-canes prevails on an extensive scale on the side of Granada, where enough is grown to supply a considerable manufacture of sugar. Formerly they had no fewer than twelve sugar-mills between Malaga and Gibraltar, the four principal of which were at Madrid, near which place the

best canes were produced. But the cultivation of cotton has been substituted there in the place of sugar. Olive-trees thrive in almost every part of the country. The olives grown in the districts of Alcala and Guadaira, in the kingdom of Seville, are larger and finer than any in Europe, and the best adapted for pickling. The greatest quantity of oil is produced in the kingdom of Valencia; viz. 88,000 quintals, or 84,615 cwt. annually. Wood is scarce in the two Castiles, Estremadura and Leon. The cables of the Spanish vessels are often made of esparto from Murcia.

In Spain several economical societies have been lately established, particularly at Valencia and Saragossa, with a view to the encouragement of agriculture; and in connection with the society of the latter place is a charitable bank in favour of distressed farmers. Money is advanced sufficient to defray the expences of harvest, and two years are allowed for returning, by instalments, the sums thus advanced. This establishment commenced its operations in June 1805, and it then distributed 458*l.* 2*s.* sterling to 110 husbandmen; and in the month of August following it had furnished sixty-two horses to an equal number of other indigent farmers. The principal economical institution for the promotion of agriculture is that at Madrid.

Manufactures and Commerce.—Spain, celebrated in remote periods for the fertility of its soil, and the variety of its productions, was equally signalized by the industry of its inhabitants. The Greeks and Romans found this country farther advanced in all kinds of useful arts than they could possibly have imagined. It was in the city of Zoela, in the district of Tarragon, that the first linen stuffs were manufactured; and the cloths of Xativa, or San Felippo, the ancient Sætabis, were famous through Greece and Italy. At Carthagena very fine stuffs were fabricated from the bark of trees; and the manufacture of woollen cloth had arrived at a high degree of perfection, and the Spaniards possessed the art of dyeing cloth of a very beautiful purple colour, which they learned of the Phœnicians, so that they supplied all Italy with this article. The Celtiberians knew the method of tempering steel, and nothing could resist the force of their swords. The manufactures of Spain, however, were injured by the invasion of the northern nations; and were again revived by the Moors, who exhibited to the Spaniards an example of genius, activity, and industry. The two nations, viz. the Moors and the Spaniards, divided between them the manufactures of Spain: those of leather, linen, silk, &c. were almost wholly in the hands of the Arabs; and those of arms, and articles fabricated of wool, were in the hands of the Spaniards. When the Moors were expelled in 1614, the manufactures which had flourished under their direction sunk into decay and ruin. The history of Spanish manufactures may be divided into three periods. The first commences with the re-union of all parts of the monarchy, under the reign of Ferdinand and Isabella; in the year 1475; and extends down to the death of Philip II. in the year 1598. The second comprises the reigns of Philip III. Philip IV. and Charles II., that is to say, during the whole of the 17th century. The third includes the 18th century; but strictly speaking, it did not begin till the year 1720.

The first was a brilliant period for Spain; manufactures of every kind were much increased, and for a time they became very famous. The second period witnessed their decline and decay, and their fall was as rapid as their elevation. Spain then no longer employed foreign merchandize. The third period furnishes an interesting index of the efforts which were used for a series of time to reinvigorate the national manufactures. During the first, Spain was in a flourishing state; but it had not then arrived at that high degree

of improvement described by the greater part of modern writers; who have affected to believe that the country then had attained the acmè of its wealth and splendour.

During the whole period that elapsed, from the commencement of the 14th to the close of the 16th century, Spain was perfectly independent of foreign nations; manufacturing the greatest part of its silk and wool, and exporting more manufactured than raw articles. But during the progress of the 17th century, the manufactures of cotton, linen, and hempen cloths, gloves, and swords, entirely vanished, and by the close of this century, scarcely the smallest vestiges remained, so that Spain was absolutely destitute of trade. When Philip V. ascended the throne, the intestine wars during the first fourteen years of that monarch's reign, and the low state of the national finances, prevented the government from paying any attention to the state of the country in this respect. Some measures were adopted for the revival of the manufactures, when tranquillity was restored. Ferdinand VI. did more for this purpose than any of his predecessors, and his successor Charles III. followed his example. The manufactures of Catalonia were the first that revived subsequent to the war waged respecting the right of succession. In a short period manufactures were established, and by a spirit of rivalry quickly multiplied. By degrees new branches of manufacture were adopted in various places, and the different ramifications are numerous at the present day. These are so numerous in the different provinces and towns of the country, that our limits will not allow an enumeration of them in this place. Some account of them occurs under the names of the respective provinces and towns, in the course of this work. The state of Spanish manufactures in the 15th and 16th centuries, will lead us to conclude that commerce was then in a flourishing condition; and its ramifications extended to all parts of Europe. Almeria, Valencia, and Barcelona, no less important, in a mercantile view, than the Hanseatic towns, pushed their commercial concerns into Syria, Egypt, Barbary, and the Archipelago. The trade of the country, however, was at this time very much, if not wholly, in the hands of the Jews; while the Spaniards were either engaged in war, or indulging themselves in a state of peace. The Moors conducted their agricultural and manufacturing concerns, and the Jews became their merchants and bankers. The expulsion of the Jews, in the year 1492, deprived Spain of its most active merchants; this was followed by the expulsion of the Moors, in 1614; so that commerce was deprived of its active and intelligent agents, and ceasing to be nourished by the produce of the soil, manufactures instantaneously disappeared. The Barbary pirates likewise infested the Mediterranean sea, and seized all the Spanish ships which sailed from the southern parts; and Spain being unable to defend commerce on the coast, the whole trade was carried on in foreign bottoms. The government also had adopted a system peculiarly calculated to paralyze commerce: it had restricted the colonial trade to entering by one port only on the continent, Seville first, and Cadiz afterwards. Moreover, during the war about the succession, Philip V. prohibited the exportation of all the produce of the country to the nations with which he was at war. The country at different times made fruitless attempts for reviving its commerce. Philip was scarcely in quiet possession of the throne, before he turned his attention to the revival of commerce; he encouraged manufactures, and conferred honorary rewards on trade; he granted premiums to merchants, and instituted commercial boards. Charles III. permitted a general trade, and moderated the duties imposed upon imported merchandize. In 1764 he established pack-

cts, which sailed regularly every month to the Havanna and Porto Rico, and others every two months for Rio de la Plata; and allowed every packet-boat to take out half a cargo of Spanish produce, and return half freighted with the productions of America. The Spaniards themselves displayed a spirit of activity and enterprise, of which they were thought to be altogether incapable. About the year 1728, the Caraccas company of Guipulcoa was established, and this company produced prompt and extensive advantages. This company was suppressed about the year 1781 or 1782. In the year 1784, a new company was formed, under the firm of "the Philippines;" and the ships belonging to this concern sailed from Cadiz; but though its commencement was promising, many unfavourable circumstances occurred, and it sustained very heavy losses; nevertheless, at the close of the year 1796 it derived a profit of nearly 229,166*l.* 13*s.* 4*d.* sterling. The internal trade of Spain is very inconsiderable, for want of sufficient means of communication; but it carries on a foreign trade with every country in Europe. The principal transactions, however, are with England, Holland, Italy, France, and its American colonies. The principal articles of foreign commerce are wine, brandy, oil, soda, barilla, fine wool, tobacco, dried raisins and figs, nuts, dates, sumac, anchovies, rice, kermes, salt, madder, bar-iron, and anchors. Although Spain exports immense quantities of its agricultural productions, it sends abroad none of its manufactured articles, but all those it receives from foreign countries. The following articles are imported into Spain, viz. from Holland, tapes, linen-drapery, common lace, cutlery goods, and paper;—from Silesia, linen-drapery;—from Germany, particularly Hamburg, quantities of haberdashery;—from England, calicoes, iron and steel goods, fine cloth, cod-fish, and ling;—from France, calicoes, linen-drapery, silk-stockings, silks, camlets, and other kinds of worsted stuffs, fine cloths, gilded articles, jewellery, iron goods, steel goods, haberdashery, and perfumery: and Spain carries on a considerable trade with her American colonies. Biscay is the only province of Spain that is interdicted a free trade with the colonies. The colonies supply Spain with coffee, sugar, some cotton, tobacco, cocoa, leather, and particularly gold and silver, both in ingots and coined into money.

The manufactures and commerce of Spain are considerably checked by the royal monopolies, which comprehend the following articles; viz. broad-cloth, at Guadalajara and Brihuega; china, at the palace of the Buen Retiro; cards, at Madrid and Malaga; glass, at St. Ildefonso; paper, in Segovia; pottery, at Talavera; saltpetre, at Madrid and various other places; stockings, at Valdenoro; swords, at Toledo; tapetry, at Madrid; and tiline, at Talavera. The king has also the monopoly of brandy, gunpowder, lead, quicksilver, sealing-wax, salt, sulphur, and tobacco. Most of the royal manufactures may be regarded as monopolies, as no private capital can vie with the treasury.

Government, Military, and Revenue.—Spain was never governed by a king who was not of foreign origin. Monarchs either of a Gothic or Moorish race, French or Austrian, or of the royal house of France, have occupied the Spanish throne from the year 411 till the present day. The Goths reigned in Spain from the year 411 till 711; the Moors from 711 till 716 in part of the Asturias, till 820 in Catalonia, till 750 in Sobrarba, till 923 in Leon, till 1073 in different parts of the two Castiles, till 1118 in Aragon, till 1236 in Cordova and Jaen, till 1248 in Seville, till 1264 in Valencia, till 1265 in Murcia, and even so late as 1492 in Granada. During the wars against the Moors, the Goths reigned

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reigned in the Asturias, Galicia, and finally in the kingdom of Leon till 1038.

The house of Navarre descended from the French house of Bigorre, which had previously reigned in Castile for ten years, united with it the crown of Leon till the year 1126. This was succeeded by the family of Bourbon, descended from the royal family of France, which reigned over these countries till 1555. The house of Charlemagne, a French family descended from that prince, ruled over Catalonia from the year 802 till 1132. The French family of Bigorre first reigned in Sobrarba, and afterwards in Aragon, from the year 750 to 1162; at that period the French family of Barcelona succeeded to the government, and united to the crown of Aragon that of Catalonia, and afterwards the kingdom of Valencia, over which it reigned till the year 1430. These parts of Spain then came into the possession of the princes of the French branch of Navarre, which reigned in Castile, and continued in their descendants to 1515; at which time the different states of the Spanish monarchy were under the government of Joanna the Foolish, who reigned over them till her death, which happened in 1555. The Austrian family then possessed the throne of Spain till 1700, since which time it was occupied by a branch of the house of Bourbon, till the late revolution, which placed the crown upon the head of Joseph I., brother of Napoleon Buonaparte, emperor of the French; but this revolution has terminated in the restoration of Ferdinand VII., who succeeded on the abdication of his father in 1808.

The Spanish government, which was of a limited nature, during the dynasties of the kings of Castile and Aragon, afterwards became an absolute monarchy.

Philip V. suppressed the states-general, their last meeting having been held at Saragossa in the year 1720; and since that period no further power is left to the Cortes of Castile and Aragon, but the privilege of sending deputies to the states-general, whenever they are summoned by the monarch. The whole authority centres at present in the king and his ministers; and the national affairs are conducted by the different councils appointed by the crown, which deliberate and form their plans in the capital: some of them possess both legislative and executive power, and exercise the double function of advising the king and administering the justice. The council of Castile, in this distribution of power, is paramount; its decrees being decisive in the courts, but its judgments are under the controul of the king. The chief councils in Spain are, 1. That of dispatches, called also the Junto, or cabinet council, being composed of the king and his ministers of state. 2. The council of state, in which the king presides, and of which the archbishop of Toledo is always a member. 3. The royal council of finances, called the Hazienda. 4. The supreme council of war. 5. The supreme council of Castile. 6. The supreme council of Aragon. 7. The supreme council of the inquisition. 8. The royal council of the orders of knighthood. 9. The royal council of the Indies. 10. That of the crusade, composed of a commissary-general, a member of the council of Castile, and another of that of Aragon, who manage the sale of little papal bulls, granting certain indulgences to the purchasers. In Spain there are five ministers of state; corresponding to our foreign secretary, secretary for the home department, secretary at war, first lord of the admiralty, and chancellor of the exchequer, or prime minister.

The laws of Spain are contained in several ancient codes; and recourse is also had to the civil and canon law. The "Escrivanos," or attorneys, are numerous, but instead of explaining the codes, they often impede the administration of justice. Mistaken mercy frequently retains criminals

in long durance, so that when they are executed their offence is forgotten, and the example of punishment has no effect.

With respect to the military of Spain we may observe, that when Philip V. ascended the throne, there were not 15,000 troops in the kingdom, and it had not a single ship of war fit for the sea. This prince directed his attention to military arrangement and discipline; and his successors, by following the same course, have obtained a respectable army; and by the increase and strength of its naval institutions, Spain has also become a maritime power. In the year 1807 the army staff included 5 captains-general, 5 inspectors, 87 lieutenant-generals, 123 field-marshal, and 213 brigadier-generals, besides military intendants, military commissioners, treasurers of the army, military judges, &c. The military establishment of the royal household consists of four companies of life-guards, a company of halbardiers or spearmen, a regiment of infantry called the Walloon guards, and a regiment of cavalry called the royal carabinieri. The life-guards are divided into four companies, the Spanish, the American, the Italian, and the Walloon; and each consists of natives of these respective countries. The militia is distinguished by the appellations of milices provinciales, or provincial militia, divided into 42 battalions, and distributed through the different provinces, and the milices urbanas, or civic militia, which neither receive pay nor are liable to be called away from their homes. The Spanish troops all wear a red cockade, except the Walloon and Swiss guards; that of the former being red and black, and that of the latter red and yellow. The whole military force of Spain, in time of peace, is computed at about 60,000. The naval forces of Spain consist of a marine staff, a corps of marine officers, a corps of naval cadet-guards, and three corps of engineers, artillery, and infantry, appropriated entirely to the service of the navy. The ships of the line can scarcely now be computed at more than 50.

The revenues of the king of Spain, on the continent, consist in monies arising from his own landed estates, customs, all kinds of taxation, &c.; which revenues amount at present, for the whole of Spain, to 8,097,813*l.* 6*s.* 4*d.* sterling, without including various considerable sums from different sources, which cannot be ascertained, for want of accurate information. The king of Spain also derives considerable revenues from the two Indies; but the expence of collecting, &c. is so great as to absorb nearly two-thirds. The total revenues of the Spanish colonies amount to 27,000,000 piastres fortes; and deducting expences, scarcely more than 9,000,000 piastres arrive at the royal treasury. The revenue of Spain has been stated by some writers at 5,500,000*l.* sterling, so that each person pays 10*s.* to government for protection. For the nature of the taxes we may refer to Laborde and Townsend's tables. The gabel is one of the most productive; and the clergy pay about 15,000,000 of rials. The expenditure now equals, or exceeds the income; and the national debt gradually enlarges. The colonies, as some of the best judges have estimated them, do not yield above 1,000,000*l.* sterling, exclusive of the duties. Bourgoing computes the revenues of Spain at 616,295,657 rials, and its money in circulation he states at 80,000,000 of dollars; estimating the rial at 5 sous of France, and the dollar at 20 rials.

Religion and ecclesiastical Government.—The religion of Spain is the Roman Catholic, professed with a degree of fanaticism which exceeds that of any Italian state, or even the Papal territory. The inquisition, established in 1480, by Ferdinand and Isabella, and lately restored with the return of the present sovereign, after its abolition, has produced

duced the most injurious effects; and the number of monks, under the obligation of celibacy, but under the influence of existing passions, has been very detrimental and even destructive to morals. The number of the Spanish clergy has been variously stated by different writers. Mr. Townsend states it at 188,625; others compute the clergy at 400,000. Laborde, in a table drawn up from the enumeration of them in 1788, reckons the secular clergy at 60,238, the ministers of churches at 15,834, the monks of 1925 convents at 49,238, and the nuns of 1081 convents at 22,347; and reckoning the population at 11,000,000, the clergy of Spain form one-sixty-ninth of the whole. Spain is divided into ecclesiastical provinces, over which presides an archbishop, with the rank of metropolitan: these provinces are again subdivided into dioceses, each of which is governed by a bishop. The archbishoprics are eight in number, and the suffragan bishoprics are forty-four. The archiepiscopal seat of Toledo is the first in rank, and the wealthiest in Spain: it confers on its possessor the title of primate, and a revenue of about 125,000*l.* sterling. The Mosarabic ritual, adopted in Spain, on the expulsion of the Arabs, declined after the introduction of the French princes, and was finally superseded by that of the Romish church. It still subsists, however, at Salamanca and Toledo, where are two chapels served by a numerous body of clergy, in which public worship is performed according to this ancient form.

The Spanish nation recognizes no authority or jurisdiction of the pope in the temporal concerns of ecclesiastical benefices. No briefs nor bulls are received, published, or executed in Spain, unless they have been examined by the chamber of Castile, and have received its *exequatur*, or licence.

In consequence of the same concordat, and of various briefs and royal edicts founded upon it, the king at present nominates not only to those benefices, the patronage of which belongs to the crown, but also to all the benefices in the patronage of the church, which become vacant during any of the eight months formerly reserved by the pope, as well as to all those that become vacant, in consequence of the former incumbents having been promoted by the king: the crown also issues licences, to enable those who are nominated to take possession of their preferments. The revenues of consistorial benefices, during their vacancy, go to the crown, on condition of their being applied to charitable uses. The annates, demi-annates, and quindennes, belong to the king, who also has the right of granting pensions on the archbishoprics and bishoprics, to the amount of one-third of their entire revenue.

The pope, however, still preserves in Spain two very important privileges, namely, the supreme administration of the *contentious jurisdiction* over all cases that are brought before the ecclesiastical tribunals, and the free and independent nomination to fifty-two of the best benefices. The imposts of various kinds and denominations, payable by the clergy of Spain, amount annually to about 437,840*l.* 18*s.* 2*d.* sterling, exclusively of some other charges. Burgoing, Townsend, Fischer, Laborde, Pinkerton.

History of the Music of Spain.—It seems as if a late musical historian had placed the Spaniards lower among European musicians, in the 15th and 16th centuries, than in equity they ought to have been, by imagining Morales the first practical musician of eminence in that country, and Salinas the only theorist that was produced there during the 16th century. (See *MORALES*.) Indeed we know but little of the state of music in the interior parts of that kingdom, during this period; but, if we may judge by the

musicians it furnished to the Papal chapel, both composers and singers, we may conclude, that the richest and most powerful nation in Europe, as Spain then was, would not breed musicians as the Africans do slaves, or the Circassians women, merely to transport them for the use or pleasure of others; they could doubtless then have afforded to keep a few for their own amusement.

The Spaniards, so far from neglecting music, seem to have taken it very early into the circle of the sciences, in their universities; for Salinas tells us, that the musical professorship, which was conferred upon him at Salamanca, had been founded and endowed by Alfonso, king of Castile, furnished the Wife. And Bartolomeo Ramis, the opponent of Franchinus, in 1482, was public professor of music at Toledo, and afterwards at Bologna. Of Guillerm de Podio, a priest, we have likewise a work, entitled “*Ars Musicorum, five Commentarium Musicæ Facultatis*,” published 1495; and another written in the Spanish language, by Francesco Trovar, “*Libro di Musica Pratica*,” Barcelona, 1519; “*Arte di Canto Llano*,” del Alfonso de Castillo, Salamanca, 1504; “*El Maestro o Musica de Vieguela de Mano*,” by Don Ludovicus Milan, a nobleman of Valentia, 1534; “*Silva di Sirenas*,” or a treatise on the vitruela, or viol, by Henrico de Valderrabano, Valladolid, 1547; “*Arte de la Musica*,” by Melchior de Torres, alcala de Herrerres, in New Castile, 1554. At the same place likewise was published, in 1557, “*Tratado de Cifra nueva para Tecla, Harpa y Vieguela Canto Llano, de Organ y Contrapunto*,” by Lud. Venegas de Hinestroia. There was likewise published at Alcala, by Cyprian de la Huerga, a Cistercian monk, who died 1560, a treatise “*De Ratione Musicæ et Instrumetorum Usû apud veteres Hebræos*,” and at Granada, 1555, “*Libro de la Declaracion de Instrumetos*,” by Joan Bermudo.

All these writers on the subject of music, and many more, appeared in Spain before Salinas; of whom an account is given under his biographical article.

Many more names of Spanish theorists and practical musicians might be enumerated here; but as we have neither seen nor heard any of their productions, we are unable to estimate their worth. In 1613, however, a work was published in Spanish, by Cerone, in folio, which contains more information concerning every part of the art and science then known, than any other elementary book which we have seen in any language. The title of this treatise is the following: “*El Mellopeo y Maestro. Tractado di Musica teorica y pratica*,” Napoli, 1613. See *CERONE*.

Andres Lorente was author of a treatise, now become very scarce, entitled “*El Porque del la Musica*,” 4to. 1672. For a farther account of this book, see *LORENTE*, and *Dr. WORGAN*.

Pablo de Zaragoza Nassarre was author also of a treatise on music, in Spanish, entitled “*Fragmentos Musicos*,” in four parts, a distinct treatise, 4to. Madrid, 1700. For a further account of this work, see *NASSARRE*.

About the middle of the last century was published at Madrid, in Spanish, “*An Essay on Church Music*,” by Feyjoo. We have never seen the book in the original, but an anonymous translation into English appeared in 1778. The author begins with a heavy complaint against the corruption and degeneracy of music, ancient and modern; joining with Plutarch in asserting, that music was at first only used in the temples of Greece; but passing to the theatre, a new and lighter style was invented, which being adopted in the temple, rendered it unfit for the serious service of religion. It was not till the latter end of the 17th century, that secular music, by additional refinements in singing, and improvements

improvements in instrumental music at the opera, was thought worthy of being introduced, on great festivals, into the church, in Roman Catholic countries: on other days, *canto fermo*, and masses set alla Palestrina, were continued, and are still continued in the cathedrals of Italy; though, even in the 16th century, masses *concertati*, or accompanied with a band of instruments, according to Montaigne, (*Journal d'un Voyage*,) were common throughout Italy and Germany.

We know not what the state of ecclesiastical music may be in Spain at present; but we have always understood that the music, *à capella*, in Spain, was more solemn and learned than elsewhere. The poet Yriarte, whose judgment and taste are correct and elegant, and who has no prejudices, except in favour of good music of every kind and country, speaks highly of the music of the church in Spain.

But Feyjoo's Essay is constant complaint and censure. Yet from the time of Charles V., an excellent musician himself, the Spanish monarchs have patronized music in a more distinguished manner, both in the church and the theatre, than any other sovereigns in Europe, till the late Charles VI., an *amouf*, who succeeded Ferdinand IV., and who turned Farinelli out of the kingdom, whose good conduct merited equal praise with his talents. See FARINELLI.

The author before us asks, whether all the music of the church should not be grave? We answer, no; not invariably. Are there not days and psalms of jubilation and thanksgiving, as well as of penitence, sorrow, and supplication! As the Calvinists confine all music to syllabic psalmody, this pious Spaniard would have no other music tolerated in the church than *canto fermo*.

We own the impropriety, and have censured it, in the admission of secular music in our cathedrals during the reign of Charles II. and his successors; when, in the compositions of Weldon and Dr. Greene, the divisions and ritornels wanted due gravity and dignity, and were manifestly introduced to display an active throat and a lively finger, for want of judgment and decorum in the composer, who forgot the place and occasion of the performance.

The Spanish writer very justly censures the admitting into the church the productions of insipid pretenders to composition, without genius or science; and finds, as is found every where else, that the number of bad composers and bad performers so far exceeds the good, that men of true genius and due cultivation are phenomena that rarely appear. Don Feyjoo has celebrated a Spanish composer, Don Antonio de Lites, whose name has never penetrated into other parts of Europe, in the highest terms of panegyric.

The Essay on Church Music was written about the middle of the last century, when the general style of Italy was frivolous, and that of Germany rude, pedantic, and inelegant; but so many great composers have appeared since in both countries, that Don Feyjoo's strictures have lost their force. There have been bad composers in all ages, but perhaps never more good ones at any period of time, than within the last 30 years.

Duron, the author, we supposed, meant Durante, was not only one of the greatest masters of harmony himself, but formed disciples of the greatest abilities that have ever issued from the Neapolitan school; but we find in Yriarte, that there had been among the masters of former times a Spanish composer of the name of Duron.

The rest of this Essay is exaggeration of invective, either to mortify Farinelli, and the great Italian composers and singers whom he engaged for the court of Spain, or to

flatter the successor of Ferdinand, who hated music, and expelled all the Italian musicians from his court.

The same anonymous gentleman has given us a translation of a letter of the learned Benedictine on the subject of music, entitled "The wonderful Effects of Music, and a Parallel between ancient and modern Music."

Here the author relates all the old stories of the miraculous powers of ancient music. He, however, doubts of the facts; and relates, *per contra*, what we have been told of the power of modern music over disease and the passions.

No new materials appear in this letter, or ingenious conjectures to determine the dispute, whether the ancients or the moderns had cultivated music most successfully; and the author leaves the subject just as he found it, without clearing up his own doubts, or those of his readers. He is always, however, inclined to give the preference to ancient music, without any thing to guide him but his prejudice, his determination to allow nothing that is new in music to be right, and the assertions by writers in favour of ancient counterpoint, that have been long since clearly confuted.

The last writer on music in Spain, that has come to our hands, is the ingenious and agreeable poet, Yriarte, of whose charming poem, "La Musica," we but lately procured the beautiful third edition, printed at the royal press in Madrid, in 1789, with elegant designs well engraved.

As this is a work but little known in our country, and does honour to the author, and to the art of practical music in all its branches, we shall be somewhat diffuse in our account of it.

D. Tomas de Yriarte writes like a man of the world, with an enlarged taste, and extensive knowledge of the subject. He has illustrated his doctrines from the most eminent moderns. Canto I. gives an outline of the general history of the musical art; calls on music itself to inspire and assist him, without applying to Apollo and his nine attendants, or even repeating old fabulous accounts of the miracles performed by Orpheus, Amphion, Linus, Terpander, or Olympus.

He describes the importance of *tone and time*. The first includes the formation of the scale, and its divisions into intervals; the second, the time-table, or musical characters for measuring the duration of sounds.

II. Musical expression; its use in the church, the theatre, the chamber, and to man alone; its powers over the passions.

III. The dignity and use of music, particularly in the temple, the theatre, in society, and in solitude; enumeration of celebrated ancient Spanish composers.

IV. Use of music in the theatre resumed; Jomelli; dancing, architecture, painting, poetry, decorations; modern composers for the lyric theatre celebrated.

V. Use of music in private society; eulogium on silence at concerts, and invective against those who attend not with due respect for the art and for talents; of opera scenes in concerts; of instrumental music proper for a concert-room; sonata, concerto, duo, trio, quartetto, symphony; necessity of variety and foreign music to keep off languor, and excite attention; praise of the German composers of instrumental music, particularly Haydn for invention; of the utility and delight which music affords in solitude, as well to those that are ignorant, as those that are learned in the art; of the study necessary for a good composer in examining the scores of celebrated authors, to detect errors and plagiarism, as well as to discover how good effects are produced; censures the pedantry of dry fugues and canons, that have no other merit than the difficulty of composing them; extraneous modulation; confusion of multiplied parts

parts in different styles and movements, which destroy the effect of each other; recommends the avoiding of all excesses of all kinds, as harmony, literally and figuratively, implies *just proportion*; celebrates the good taste which is manifest in the Royal Academy at Madrid, in the public distribution of premiums to artists in painting, sculpture, architecture, and engraving; to which have been added poetry and eloquence. It is proposed, in addition to all these arts, to establish an academy, or scientific body of music.

In the course of this last canto there is an animated eulogy on Haydn.

“Sólo á ta número, Háydén prodigioso,” &c.

“To thee alone the muses have confin’d
A genius ever fertile and refin’d;
So new thy strains, so copiously inspir’d,
That curiosity is never tir’d;
Thy works a thousand times repeated, still
With rapture new experienc’d ears can fill.

To sooth, to calm, or noble deeds inspire,
Thy fancy still is fed with heaven’s own fire.
In every trait a judge profound can find
Some grace or beauty of a higher kind;
Expression touching, modulation new,
In themes which none but gifted men pursue.

Surrounded by thy countrymen renown’d,
In thee alone the listening world has found
A power to interest, and render dear
Each sweet vibration of th’ enraptur’d ear.
To distant climes the happy means convey,
As light and heat sent forth from solar ray,
And while these inspirations wide expand,
Conferring honours on thy native land.”

SPAITLA, a town of Africa, in the kingdom of Tunis, anciently called “Sufetela,” represented by Dr. Shaw as one of the most remarkable places in Barbary for the extent and magnificence of its ruins. Here are found a triumphal arch of the Corinthian order; a pavement of large black stone, with a breast-high parapet on each side, which leads from the arch to the city; a beautiful portico at the end of the pavement, opening into a spacious court; the ruins of three contiguous temples, of which the columns, pediments, and entablatures are entire, &c. &c. Spaitla is pleasantly situated upon an eminence, shaded all over with juniper-trees; 110 miles S.W. of Tunis. N. lat. 35° 10'. E. long. 9° 10'.

SPALATRO, a sea-port of Dalmatia, situated on a peninsula, with a good harbour; the see of an archbishop. The harbour is large and deep, and well frequented by foreign vessels, which come for merchandize from Bosnia, such as iron, hides, wrought copper, wool, blankets, beeswax, orpiment, silk, cotton. Spalatro is built on the ruins of Dioclesian’s palace, for an account of which see SALONA. Without the walls is a sulphureous spring, of considerable service in chronical diseases. N. lat. 43° 22'. E. long. 16° 45'.

SPALDING, an ancient and respectable market-town in the wapentake of Elloe, parts of Holland, and county of Lincoln, England, is situated 8 miles W. from Holbeach, 41 miles S.E. from Lincoln, and 101 N. from London. Being in the midst of a fenny district, and almost encompassed by the river Welland, and an ancient drain called the Well-lode, and having numerous other drains in its vicinity, Spalding has been, with some degree of propriety, compared to a Dutch town. Though thus situated, and not apparently

congenial to healthfulness, its claim to antiquity is testified by many remains discovered in and about the town. That it certainly existed before the foundation of Croyland abbey, is evinced by king Ethelbald’s charter to that monastery, describing its bounds as extending “*usque ad ædificia Spaldeling.*” Prior to the Conquest the manor was the property of Algar, earl of Mercia; but was granted by the conqueror, with the whole of the division of Holland, to his nephew, Ivo Taillebois, who erected a castle here, of which the moat was to be distinguished in 1746, in that part of the Castle-fields called Coney Garth. In the year 1051, Thorold de Bokenhale founded and endowed a priory here, and made it a cell to Croyland; but the inhabitants were forced to abandon it after the Conquest, through the oppression of Taillebois, who about 1074 gave the church and manor to the abbey of St. Nicholas at Angiers, whence some Benedictine monks were sent over, and it became an alien priory. It was in succeeding times a monastery of great consequence. From this place Egelric, abbot of Croyland, made a firm causeway, named Elrick-road, through the marsh called Arundel forest, to Deeping, being an extent of twelve miles. It was formed by driving in piles of wood, which were covered with gravel. This road is now distinguished by the name of “The Gravel.” The conventual church not being sufficiently large, the prior pulled it down in 1284, and built the present parish church, which is a light structure, with a handsome spire, having crockets at the angles: the porch appears to have been added about the end of the 15th century. A free grammar-school was erected in the reign of Elizabeth, by the will of John Blanch. Another, called the Petty school, was founded in 1682, by Thomas Wellesley; here is also a blue-coat charity-school. An almshouse for twenty-two persons was founded in 1590; and another for eight widows in 1709.

For many centuries Spalding has been the principal seat of jurisdiction for the division of Holland. In the Saxon times the courts of law were held here by the earls; and subsequent to the Norman Conquest, the priors were invested with the judicial authority: even capital offences were cognizable in the conventual court. But at the dissolution of religious houses, the power of deciding on life and death was removed from all such inferior courts. Since that time a court of sessions has been held here; for which purpose a town-hall, or court-house, was erected, at the expence of Mr. John Holstan, at the north-west end of the market-place; the upper rooms are used for the quarter-sessions, the courts-leet and baron, and the courts of request and sewers; the lower part of the building is let out for shops, and the rents appropriated to the use of the poor, conformably to the will of the donor. Spalding, since the river Welland has been made navigable to the town, has had a good carrying and coaling trade. Barges of about 40 tons burthen come up to the centre of the town, where are quays and spacious store-houses: but vessels requiring a larger draught come only to Boston Scalp, nine miles distant. Attempts have been made to introduce manufactures into Spalding, but without success: the town derives its chief support from agriculture, and the extensive grazing carried on in its neighbourhood. Wool consequently forms a very prominent article in its trade; and some of the manufacturing towns of Yorkshire and Norfolk are supplied from hence. A market is held on Tuesdays, and five fairs annually, besides two statutes for hiring servants. In the population return of the year 1811, the number of houses was stated to be 951; the inhabitants 4330.

A literary society was established at Spalding in the beginning of the last century, under the auspices of Mr. Maurice Johnson,

Johnson, an eminent native of this town, on the principle of that of the antiquaries of London; to which transcripts of the minutes and records were regularly sent for upwards of forty years, till the death of Mr. Johnson, which happened in 1755.

In the vicinity of Spalding is Ayfcough Fee-Hall, the residence of Maurice Johnson, D.D., a descendant of Mr. Johnson above-mentioned. The mansion was built about 1420, but having been altered at different times, exhibits scarcely any thing of its original architecture. The present possessor has, however, endeavoured to restore it to its ancient character.

At Pinchbeck, about three miles north of Spalding, are some considerable remains of an ancient mansion, formerly called Pinchbeck-Hall, from a family of that name. Being afterwards possessed by the Otway family, it acquired the appellation of Otway-Hall. It appears to have been an extensive structure, and to have been built about the time of Henry VIII. It was moated round, and some of the windows have pointed lights with square heads. The chimnies are singularly lofty, and the gable ends have at the sides and centres, spire-shaped ornaments, crowned with ornamental balls. Beauties of England and Wales, vol. ix. Lincolnshire, by J. Britton, F.S.A.

SPALES, CROSS-SPALES, in *Ship-Building*, are deals or fir-planks, nailed in a temporary manner to the frames of the ship, at a certain height, and by which the frames are kept to their proper breadths, until some of the deck-knees are fastened. The main and top-timber-breadths are the heights frequently taken for spaling the frames, but that of the gun-deck ports is much better; yet this may be thought too high, if the ship is long in building.

SPALETHRA, or SPALATHRA, in *Ancient Geography*, a town of Greece, in Thessaly. Steph. Byz. Scylax states it to be a maritime town of Magnesia.

SPALMADORI, in *Geography*, a small island in the Grecian Archipelago, between the island of Scio and the continent of Asia. N. lat. $38^{\circ} 36'$. E. long. $26^{\circ} 7'$.

SPALT, a town of Bavaria, in the bishopric of Aichstat; 16 miles E.S.E. of Anspach. N. lat. $49^{\circ} 7'$. E. long. $10^{\circ} 52'$.

SPAN, a measure taken from the space between the thumb's end and the tip of the little finger, when both are stretched out.

The span is estimated at three hands' breadths, or nine inches.

SPAN, in *Rigging*, a short rope, having a block, thimble, or eye, spliced into each end: the middle is hitched round a mast, yard, gaff, cap, or stay, from whence the ends branch out. Spans are sometimes fastened at both ends, and a block, &c. in the bight. They are used to lead ropes through, which pass through blocks or thimbles, to increase power, or to prevent their swinging about. *Spanning of booms*, is confining them by several turns of rope. *Spanning of runners*, is taking several turns with small rope round both runners, abast the mast, and frapping the turns.

SPAN-*Shackle*, a bolt having a large ring in the head of it.

SPANANTHE, in *Botany*, a genus of umbelliferous plants, received by Jacquin from the Caraccas, and so named by him, from *σπανος*, rare, and *ανθος*, a flower, because of the scarcity of this tribe in tropical countries.—Jacq. Coll. v. 3. 248. Sprengel Umbellif. Prodr. 34.—Clafs and order, *Pentandria Digynia*. Nat. Ord. *Umbellifera*.

Gen. Ch. Cal. Umbel simple, of several rays; involucre of several lanceolate leaves; perianth of five ovate, acute, permanent leaves. Cor. *Universal* uniform; all the

flowers perfect and fertile; *partial* of five lanceolate, inflexed petals, channelled at the back. *Stam.* Filaments five, awl-shaped, erect, about as long as the petals; anthers roundish, of two lobes. *Pistl.* Germen inferior, ovate, rather compressed, with two lateral furrows, prominent, blunt and divided at the summit; styles two, awl-shaped, divaricated, shorter than the stamens; stigmas simple. *Peric.* none; fruit ovate, solid, transversely divisible into two parts. *Seeds* two, five-ribbed, contracted at their conjunction, convex at their sides.

Ess. Ch. Umbel simple. Involucrum of many leaves. Perianth of five permanent leaves. Petals undivided. Fruit oblong-ovate, solid. Seeds five-ribbed; contracted at their conjunction; convex at the sides.

1. *S. paniculata*. Panicked Spananthe. Jacq. Coll. v. 3. 247. Ic. Rar. t. 350. (Hydrocotyle Spananthe; Willd Sp. Pl. v. 1. 1363. Ait. Hort. Kew. v. 2. 118.)—Native of the Caraccas, according to Jacquin. It was also found in moist places near Lima, by Dombey, one of whose specimens, under the name of *Pbellandrium ciliatum*, was given to the younger Linnæus. We received a living one from the stove at Kew, in October 1790, an earlier period by five years, than is marked for the introduction of this curious plant by Mr. Aiton. The root is biennial, consisting of many fibres. *Stem* from one to three feet high, erect, branched, leafy, round, striated, smooth, hollow; sometimes partly zigzag. *Leaves* alternate, on long stalks, simple, triangular, or somewhat heart-shaped, from one to three inches broad, pointed, copiously ferrated; entire at the base; reticulated with numerous veins, which, on the upper side especially, bear a greater or less number of bristly hairs; the under side is paler and nearly smooth. The insertion of the footstalk is marked with a tuft of bristly hairs. *Stipulas* oblong, membranous, fringed, united to the base of the footstalk. *Umbels* simple, small, on long stalks, variously collected into branched panicles, or sometimes irregular compound umbels, accompanied by ovate, or lanceolate, ferrated *bracteas*. *Petals* white, inflexed, and partly heart-shaped; by no means so flat and spreading as in Jacquin's figure, from whence his description seems to be taken. We have not seen the ripe fruit, and have therefore been obliged to form our description thereof from Jacquin and Sprengel. The latter, in the *Prodromus* of his new arrangement of the *Umbellifera*, of which we hope to speak hereafter, in its proper place, has widely separated this plant from *Hydrocotyle*; and we have already, see HYDROCOTYLE, n. 13, hinted a doubt on this subject, which was suggested by the very different habit of *Spananthe*. But surely the learned author last named has widely erred, in classing *Hydrocotyle* among the genera with compressed flat fruit, like *Tordylium*, *Heracleum*, &c. Its fruit indeed is compressed, but transversely, not laterally, so as not to differ in that respect from the present genus; which, however, appears to us sufficiently marked by its large and permanent *perianthium*, to say nothing of the more oblong, and not semi-orbicular, shape of its seeds. If we were furnished with these in a perfect state, we should probably find other distinctive characters.

SPANCEL, in *Rural Economy*, a term signifying a rope to tie a cow's hinder legs while milking, &c.

SPANDAU, in *Biography*, a very pleasing and extraordinary performer on the French horn, in the service of the stadtholder at the Hague in 1772, who in 1773 came to England, where he was heard with the greatest pleasure. He contrived in his performance so to correct the natural imperfections of the horn, as to make it a chamber instrument. He played in all keys, with an equality of tone, and

as much accuracy of intonation in the chromatic notes, as could be done on a violin; by which means, and his delicacy, taste, and expression, he rendered an instrument which, from its force and coarseness, could formerly be only supported in the open air, in theatres, or spacious buildings, equally soft and pleasing with the sweetest human voice. In 1783 some exquisite pieces for the horn of his composition were circulated in MS. from the German and Dutch music-shops; but we believe they were never printed.

SPANDAU, in *Geography*, a town of Brandenburg, in the Middle Mark, situated on the Havel, at its union with the Spree. This town, though not large, is both flourishing and populous, with a considerable foundery of arms; 11 miles N.E. of Potsdam. N. lat. $52^{\circ} 33'$. E. long. $13^{\circ} 11'$.

SPANDEN, a town of Prussia, in Oberland; 14 miles E. of Holland.

SPANDONCEA, in *Botany*, a genus so called by professor Desfontaines, in honour of M. van Spaendonck, botanical draughtsman at the Royal Garden of Paris. This genus had previously been named in Italy *Panciatia*, and originally by Forkall *Cadia*; which last appellation, though of Arabian origin, has been retained. See CADIA.

SPANDRIL, in *Architecture*, the open space between the outward moulding of an arch, from its impost to the horizontal member or line which surmounts it.

SPANGENBERG, in *Geography*, a town of the principality of Hesse Cassel; 17 miles S.E. of Cassel. N. lat. $51^{\circ} 8'$. E. long. $9^{\circ} 36'$.

SPANGLES for *Paper-hangings*. See PAPER-hangings.

SPANHEIM, FREDERIC, in *Biography*, an eminent theological professor, was born in 1600, at Amberg, in the Upper Palatinate, where his father held an office in the electoral court. He studied at Heidelberg and Geneva, and in 1621 engaged himself as preceptor in the family of the governor of Ambrun, in Dauphiné, where he remained three years. From thence he passed to Paris, and afterwards paid a visit to England, and returning to Geneva, he obtained a chair of philosophy in the college in 1626. Soon after this he was admitted a minister, and in 1631 he succeeded M. B. Turretin in the professorship of theology at Geneva. The reputation which he acquired in the exercise of this office procured him various invitations, and having accepted one from the university of Leyden, he removed thither in 1642. In this situation he augmented his former reputation, as well by his lectures and sermons, as by the works which he composed. He passed a very laborious life, and died in the 50th year of his age. He was supposed to have shortened his days by the greatness of his labours, which are thus described. "He gave public lectures in theology four times a week, and private lectures of different kinds to his pupils; he examined candidates, and preached in two languages, *viz.* the German and the French: he was accustomed frequently to visit the sick, wrote a vast number of letters, and would compose, at the same time, two or three books on different subjects: he assisted every Wednesday at the prince of Orange's council at the Hague, and was rector of the university. Amidst all these various occupations, he found leisure to keep the accounts of his house, which was always well filled with boarders." Spanheim was a man of great learning and capacity, and he is thus characterized by Saumaïse, who felt no love for him. "He had a strong head, well filled with erudition: he was fitted for business, firm, ardent, and industrious. He was a rigid opponent of all that he regarded as innovation in doctrine; and readily entered into controversy, not only with the enemies, but with the friends of the church, when he suspected that they deviated from orthodoxy." He never, it is said, suffered phi-

losophy to intrude into the mysteries of theology, but exerted all efforts to keep the latter uncontaminated. His works were very numerous, and on divers subjects: some were political, as "Le Soldat Suedois," composed at the request of the Swedish ambassador; "Mercurie Suisse;" "Commentaire historique de la Vie et de la Mort de Christophe, Vicomte de Dhona;" "Memoires sur la Princesse Louise Juliane, Electrice Palatine." These were all published without his name: of his theological works, the principal is one on "Universal Grace;" "Dubia Evangelica;" "Epistola ad Buchananum de controversiis Ecclesiæ Anglicanæ;" "De Autore Epistolæ ad Hebræos."

SPANHEIM, FREDERIC, second son of the preceding, was born at Geneva in 1632, was likewise a professor of theology of high reputation. He studied under his father at Leyden, and began his career as a preacher in 1652, and by his overbearing eloquence, excited the jealousy of Alexander More, then famous in the United Provinces. Receiving an invitation from the elector-palatine to occupy the chair of theology at Heidelberg, he took the degree of D.D. at Leyden in 1655, and then took possession of his post. He acquired the esteem and confidence of the elector; and it is to the honour of both, that he did not forfeit them when he was the only person who strongly and firmly opposed that prince's design of divorcing his wife, and remarrying. He received invitations from several other universities, and accepted that from Leyden in 1670, when he was made professor of theology and sacred history, in performing the duties of which he acquired a very high reputation. His life was disquieted by some controversies in which he engaged, and into which none should enter who have not strong nerves, that will bear to be assailed by the weapons of an enemy. For several years before his death he was allowed to omit his duties as lecturer, in order that he might devote his whole time to learned writings. These were so numerous, that when collected, they filled three volumes in folio, which were printed at Leyden in 1701-3; in the former of these years the learned professor died. Among his works the most esteemed is a summary of ecclesiastical history of the 16th century.

SPANHEIM, EZEKIEL, an eminent scholar and statesman, eldest son of Frederic, was born at Geneva in 1629. He accompanied his father to Leyden in 1642, when he was already far advanced in the knowledge of the learned languages, and he soon acquired the esteem both of Saumaïse and Helvetius, who at this period were residents in that university. In 1651 he was nominated professor of the belles lettres at Geneva, and in the following year was admitted into the great council. His high reputation caused him soon after to be invited by the emperor to superintend the education of his only son, and in this situation he applied himself to gain a thorough knowledge of the public law of Germany. Having obtained leave to travel into Italy, he was charged by his master to watch over the political intrigues of the Catholic electors at Rome; and at the same time he made himself acquainted with the science of medals and classical antiquity. While out on this tour he was introduced to the celebrated CHRISTINA (see her article), then residing at Rome, who favoured him with a gracious reception, and also to the still more illustrious lady Sophia, electress of Hanover, who brought him back with her to Heidelberg in 1665. The elector-palatine, then engaged in various other projects, permitted Spanheim to enter into the service of the elector of Brandenburg, for whom he resided nine years in the quality of envoy-extraordinary. On his return to Berlin he was made one of the ministers of the state, and at the peace of Ryfwick, he was deputed again

to France. The elector, being now acknowledged king of Prussia, conferred upon M. Spanheim the title of baron, and sent him in the character of extraordinary minister to queen Anne of England. He was received at her court with all the respect and honour due to his merit, and was, on account of his talents, elected fellow of the Royal Society. He died in this country, at the age of 81. It is said of this author, that he filled his diplomatic character as if he were entirely detached from letters, and his literary character as if he had no concern with politics. His erudition was solid and extensive, of which he gave various proofs in his writings. The earliest of these were either theological or juridical; but he is best known as an antiquarian and critic. "His work," says his biographer, "entitled 'De Usu et Prestantia Numismatum Antiquorum,' in two volumes folio, is accounted one of the best treatises that ever appeared on the medallic science." His translation into French of the "Cæsars," of the emperor Julian, with illustrations; his edition of the same work, with a preface and notes; and his observations on Callimachus and other authors, with some dissertations on subjects of antiquity in the collection of Grævius, are reckoned extremely valuable contributions to critical literature. The wife of this learned professor, who died the year before him, was worthy to be his partner, from her extraordinary acquisitions, being mistress of various languages, and well acquainted with the philosophy of the ancients.

SPANIARD'S BAY, in *Geography*, a bay on the E. coast of the island of Cape Breton.—Also, a bay on the N. coast of the same island. N. lat. 46° 15'. W. long. 60° 20'.

SPANIEL, HISPANIOLUS, or *Canis Avicularius* of Linnæus, a variety of the *Canis familiaris*, a species of dog used in fowling. See DOG.

From the name, it may be supposed that we were indebted to Spain for this breed. There are two varieties of this kind; the first formerly used in hawking to spring the game, the same with our starters; the others used only for the net, and formerly called *index*, or *fetter*. This kingdom has been remarkable for producing dogs of this sort, particular care having been taken to preserve the breed in the utmost purity. They are distinguished by the name of English spaniels; so that, notwithstanding the derivation of the name, it is more than probable they are natives of Great Britain.

The pointer, which is a dog of foreign extraction, was unknown to our ancestors.

The aquaticus, or finder, in Dr. Caius's systematic arrangement (see DOG), was the same with our water spaniel, and used to find or recover the game that was lost.

The spaniel is of great use, but subject to many distempers; among these the mange is a very frequent one, and is the most pernicious of all others to his quiet and his beauty; and is very apt, when one dog has it, to spread to others that come in its way. As a remedy for this disease, some have recommended a decoction of a large quantity of brimstone, with some common salt and wood-ashes, in water and urine, of each equal quantities: this is to be used three or four times a day, washing the creature well with it before the fire, or in the warm sun. If this is not strong enough, the same ingredients, with the addition of a considerable quantity of wood-foot, are to be boiled in strong vinegar, and the liquor used in the same manner; but this must never be used in cold weather, as it would then endanger the creature's life.

When this disease is not in a violent degree, it may be cured by the herb agrimony internally taken. The method

is to pound the roots, leaves, and seeds of this plant in a mortar, and mix them with a large quantity of wheaten-bran; they are to be then made into dough in the common way, and baked in an oven; the dog is to have no other bread but this for some time, but he is to eat of this as often and as much as he will: this, without any further care, has cured many. See *Diseases of Dogs*, under DOG.

Another very troublesome disorder in this creature, is what is called the *formica*: this infests only the ears, and is caused by flies, and by the dog's scratching for them. The best medicine for the cure of these is this: take a quantity of pure and clean gum tragacanth, infuse it in white-wine vinegar; let as much vinegar be used as will serve to soften it, and when it has lain a week in it, let it be taken out and ground on a marble, as the painters grind their colours, adding to it rock-alum and galls, reduced to powder, of each two ounces; all this is to be well mixed together, and the matter, if it grows too stiff in the grinding, is to be moistened with some of the vinegar in which the gum was soaked: when all is thoroughly mixed, and ground fine, it is to be put in a gallypot, and a small quantity of it applied to the creature's ear every night, till the complaint is removed.

The swelling of the throat is another disease very common to spaniels, but the cure of this is easy; there needs only to bathe it well with oil of chamomile, and afterwards wash it with a mixture of vinegar and salt; this done night and morning, will, in a few days, wholly remove the complaint. Spaniels will sometimes, when they have much rest and good food, lose their sense of smelling, but this is recovered by a brisk purge and repeated airings; a very common dose, on this occasion, is a drachm of jalap, and two drachms of sal gem, mixed up into a bolus with oxymel of squills: this is to be rubbed over with some butter, and will be got down in that manner pretty easily, and will work briskly.

SPANIEL, *Gentle*. See LAP-DOG.

SPANISH *Academy, Bible, Black, Brown, Coinage, Coins, Epocha, Inquisition, Language, Measures, Order, Plough, Silk, Soap, Wax, and White*. See each article, and SPAIN.

SPANISH, or *Lisbon, Bean*, in *Agriculture*, the common name of a particular sort of bean, which is smaller than the long pod kind, but which ripens about the same time, and is very productive. See BEAN.

SPANISH *Broom*, in *Botany*. See SPARTIUM.

SPANISH *Chestnut*, in *Planting*, a tree of the deciduous timber kind. See CHESTNUT-TREE.

This is a most valuable sort of tree, as it affords, in a quick, speedy, and abundant manner, the best sort of hop-pole that has yet been met with, and which far surpasses that of the ash, being considerably more durable.

SPANISH *Elm*, in *Botany*. See CORDIA.

SPANISH *Flies*. See CANTHARIDES.

SPANISH *Juice*. See LIQUORICE.

SPANISH *Potatoes*, in *Gardening*, the common name of a plant producing white, tuberos, eatable roots, somewhat like large kidney potatoes of the same colour, and of a sweetish taste. They are usually brought here from Spain. See CONVOLVULUS.

SPANISH *Sheep*, in *Agriculture*, a breed of very fine short-woolled sheep, originally imported into this country from Spain. See SHEEP.

SPANISH *Windlass*. See WINDLASS.

SPANISH *Wool*. See SHEEP and WOOL.

SPANISH *Cove*, in *Geography*, a creek at the western extremity of the county of Cork, Ireland, between Crookhaven and Mizen Point.

SPANISH Creek, a river of Florida, which runs into the river St. Mary.

SPANISH Main, that part of the Atlantic ocean which washes the N. part of South America, from the Leeward islands to the isthmus of Darien. The term is also applied to the coast.

SPANISH Point, a cape on the N.E. coast of the island of St. Vincent. N. lat. $13^{\circ} 24'$. W. long. $61^{\circ} 12'$.

SPANISH River, a river and settlement on the island of Cape Breton.

SPANISH Town, or *St. Jago de la Vega*, a sea-port town of Middlesex county, and capital of the island of Jamaica, situated on the banks of the river Cobre, about six miles from the sea, and containing between 500 and 600 houses, and about 5000 inhabitants, including free people of colour. It is the residence of the governor, or commander-in-chief, who is accommodated with a superb palace; and here the legislature is convened, and the court of chancery and the supreme court of judicature are held. N. lat. $18^{\circ} 1'$. W. long. $76^{\circ} 44'$. See JAMAICA.

SPANISH Town, or *Virgin Gorda*, one of the Virgin islands in the West Indies, called also Pennilton, belonging to the English, and having two good harbours. N. lat. $18^{\circ} 20'$. W. long. $63^{\circ} 48'$. See VIRGIN ISLANDS.

SPANN, in *Commerce*, a corn-measure of Sweden; two spans being equal to a *Tunna*; which see.

SPANNBERG, in *Geography*, a town of Austria; 5 miles S. of Zisterzdorff.

SPANNER, in *Rural Economy*, the name of a wrench or nut screw-driver, which is often very useful for the farmer.

SPAR, in *Mineralogy*, a name given by working miners in England to all crystallized minerals which have a shining lustre: it is synonymous with *spath*, from the German.

The observation that spar is continually formed at this time in caves and grottoes under ground, has given birth to many different conjectures as to the origin of that substance. We have accounts from Switzerland, and other places, that the snow, by long lying on the earth, and being subject to repeated freezing, is at length hardened into spar: this is much of the nature of that opinion of the ancients concerning crystal, that it was water frozen by severe colds to a sort of ice, much harder than the common kind: both are equally erroneous and absurd. But more rational conjectures, as to its original, are, that it is produced either by effluvia alone, or by the joint force of effluvia issuing up from the depths of the earth, and mixing with water oozing out of rocks into their cracks and cavities, or by the same water or effluvia passing through beds of this sparry matter contained in clay. In the first place, we are to observe, that spar is capable of being dissolved either by water or vapour, and suspended imperceptibly in either; and that though it remains suspended a long time, yet there are occasions of its separating itself from either of these vehicles; such are long standing still, and evaporation. What is called the growth and formation of spar, therefore, is properly perhaps only the change of place in this substance; and all that these agents, waters and vapours do, is only to wash it out of the strata of earth or stone, in which it lay in scattered particles, and bring it together into the cracks and crevices of stones, where it may again separate itself, and become more pure and perfect.

The operation of nature, in this case, is very like that of art in extracting of salts from the various bodies they are mixed with; and spar, in its two states, when blended in the strata of stone, &c. and when pure, and in form of crystals in the cracks, may be compared to alum, for

instance, in its bed, and when purified. The alum, in the common stones from which it is made, is not perceptible to the eye, but lies in scattered particles; water being added to this, takes up the salt, and when it has been managed by evaporation and rest, yields it again purified and alone, and it forms such crystals on the sides of the vessel as the other does on the sides of the fissures of stone, which are the vessels where the water, out of which it was formed, was set to evaporate, and to rest a proper time.

That some spars grow from vapours alone is evident, from the stalactites, or stony icicles, hanging down from the roofs of our caverns, which, though they grow downwards, yet have many times little plants of the same substance growing out at their sides, and standing upwards, contrary to the growth of the other, and evidently formed of the matter separated from the vapours in their ascent, as the stalactites themselves are from such as have ascended to the roof, and there been condensed into water, and sent down again in drops. Nor is the sparry matter alone thus raised in vapour, for even the metals, and other bodies as little likely as those to be thus raised, yet are found to form stalactites.

The mundics, in general, though they never form regular stalactites, yet often are found adhering to the sides of them, and the metals, particularly iron and lead, form regular stalactites; the iron ones very common and very perfect; the lead less perfect and more rare; and Dr. Brown gives us abundant instances of spars growing entirely from vapours in the baths of Buda in Hungary.

Mr. Beaumont is of opinion, that earth by degrees will ripen into spar; but this is an error. He founds his opinion on certain stalactites, and stalagmites, found in caverns, partly earth, and partly spar, and supposes that the whole would in time become spar; but there is nothing in nature to warrant this conjecture. Phil. Trans. N^o 129.

M. de Jussieu has given us, in the Memoirs of the Paris Academy, a very remarkable account of the recrystallization, or reproduction, of the parts of spar, after solution. Mem. Acad. Paris, 1719.

The denomination of spars, says the editor of the Chemical Dictionary, is given to many stones of different properties and appearances, which do not possess constantly any one common character or mark, by which they may be certainly distinguished from other stones. In general, we may observe, that they are most frequently found in mines, and that they generally consist of smooth and shining plates or laminæ; that some are transparent, and others opaque; that some are colourless and others coloured; that they are crystallized in various determinate figures, or possess no determinate shape; and, lastly, that they differ so much in hardness, density, degree of fusibility, and in their most essential chemical properties, that they cannot be considered as forming a distinct class of fossil substances.

The several stones to which the name of spar has been given are, the calcareous, the gypseous, the fluors, and felspar. Calcareous spars are soft heavy stones, which have the common chemical properties of calcareous earth. The texture is laminated, some of them have no determinate figure, and others from their form are called rhomboidal. Some spars, called dog's-tooth spars, have a pyramidal figure; but when these are broken, their fragments shew that they also consist of rhomboidal particles. Some rhomboidal spars are transparent, others are opaque; some are colourless, and others are coloured; and some of them have a property of doubly refracting the rays of light: this spar has been called refracting spar, or island crystal. Its figure

is that of an oblique parallelepiped, contained within six parallelogrammic sides, and eight solid angles. Each of the obtuse angles of the parallelograms is $101^{\circ} 52'$; and each of the acute angles is $78^{\circ} 8'$. These calcareous spars may be distinguished from others by effervescing with acids.

The gypseous, or selenitic spars, are gypseous earth, distinctly crystallized. The form of the crystals is rhomboidal. They are also called selenites and glacies Mariæ. These spars sometimes assume other forms, and are very heavy.

Mr. Margraaf has shewn, that under this class are to be comprehended those white opaque spars, which by calcination with inflammable matters are capable of receiving a phosphoric quality, similar to that of the Bolognian stone, which he also shews is a gypseous spar. For the spars called fluors, see FLUOR.

The felspar, or *spatum scintillans*, differs from all the preceding, in being too hard as to be capable of striking ignited sparks from steel. For which reason it is referred by Cronstedt to the siliceous class of earths, and by him called rhombic quartz, because the particles of which it consist seem to be parallelepipeds, each of which is contained within six rhomboidal sides. Its colours are various, white, grey, and red.

Several other fossil substances consist of large plates, and are, therefore, said to have a sparry texture. Such are some kinds of talcs, of hornblende, of quartz, of amianthus, and some calciform ores of metals.

SPARS, in *Medicine*, have from the earliest times been recommended in nephritic complaints. Some have used one kind, some another, as the lapis judaicus, the sparry incrustations of caverns, petrified oyster-shells, and water in which large quantities of spar are sustained. After all, the nephritic virtues of spar want sufficient proof; some even suspect its use to be more hurtful than beneficial. See CRYSTAL.

SPARADRAP, SPARADRAPUM, in *Pharmacy*, &c. an ancient name for a kind of fear-cloth; or a linen-cloth smeared on both sides with some kind of plaster, or unguent.

The sparadrap is sometimes also called *tela Gualteriana*, or *tela Gualteri*; sometimes *tela emplastica*.

It is prepared by melting a sufficient quantity of some plaster or unguent, and dipping a linen-cloth therein, till such time as it hath imbibed its fill. It is then taken out, cooled, and polished on a marble.

SPARAGUS, or ASPARAGUS, *Sprage*, in *Botany*. See ASPARAGUS.

SPARAXIS, so named by Mr. Gawler, now Ker Belenden, from *σπαρξεν*, a tearing, or plucking, in allusion to the torn appearance of the sheath, which makes a principal part of the generic character.—Ker in Sims and Kon. Ann. of Bot. v. 1. 225. Ait. Hort. Kew. v. 1. 85.—Class and order, *Triandria Monogynia*. Nat. Ord. *Ensatæ*, Linn. *Irides*, Just.

Gen. Ch. *Cal.* Sheath inferior, of two membranous, dry, unequal, clasping valves, torn and shrivelled at the extremity. *Cor.* of one petal, superior; tube funnel-shaped, slender at the base; limb dilated, in six segments, either regular or irregular, spreading or partly erect. *Stam.* Filaments three, inserted into the upper part of the tube, thread-shaped, straight, a little inclining, rarely ascending, much shorter than the limb; anthers oblong, incumbent. *Pist.* Germen triangular; style thread-shaped; stigma three, spreading, recurved, oblong, downy. *Peric.* Capsule roundish-oblong, full of unequal swellings, thin, of three cells and three valves. *Seeds* numerous, globose.

Ess. Ch. Sheath of two valves, membranous, dry, jagged. Corolla tubular. Stigmas three, oblong, recurved. Capsule roundish-oblong, tumid.

Obf. The character of this genus chiefly depends on its sheath, which is large, and exhibits its distinctive marks, as above described, sufficiently clearly. The limb of the corolla is either regular and spreading, or converging downwards, or two-lipped, with an erect hood; in which last case the *stamens* and *style* are upright, otherwise spreading, or inclining. The *bulb* is solid, ovate, pointed, clothed with reticulated scales. The *stem* most frequently bears axillary bulbous buds. *Leaves* from six to ten, sword-shaped, with fine parallel ribs. *Flowers* rather large, and somewhat distant from each other; never crowded or numerous. *Ker.*

1. *S. anemoniflora*. Large White Sparaxis. Ker n. 1. (*Ixia anemoniflora*; Willd. Sp. Pl. v. 1. 200. Jacq. Ic. Rar. t. 273.)—Stem single-flowered, as tall as the leaves. Corolla regular; its segments obovate, four times as long as the tube.—Native of the Cape of Good Hope. Cultivated by Jacquin. The *stem* is about a foot high, simple, oblique, with five or six leaves at the bottom only, which are linear and glaucous, the longest of them nearly equal to the stem. *Flower* two inches in diameter, pure white, with yellow anthers; its tube equal to the sheath, which measures about a quarter of an inch.

2. *S. fragrans*. Sweet Yellow Sparaxis. Ker n. 2. (*Ixia fragrans*; Willd. Sp. Pl. v. 1. 197. Jacq. Ic. Rar. t. 274.)—Stem usually two-flowered, shorter than the recurved leaves. Corolla regular; its segments elliptic-lanceolate, thrice as long as the tube.—Native of the Cape. Cultivated by Jacquin. *Stem* a span high, leafy. *Leaves* linear, narrow, green, about twice the length of the stem, all more or less recurved. *Flowers* about half the size of the foregoing, yellow, with white many-cleft sheaths.

3. *S. tricolor*. Three-coloured Sparaxis. Ker n. 3. Ait. n. 1. (*Ixia tricolor*; Curt. Mag. t. 381. Schneevogt. Ic. t. 39. Redout. Liliac. t. 129.)—Stem two or three-flowered, taller than the erect lanceolate leaves. Corolla regular; its segments obovate, twice the length of the tube. Sheath corrugated, spotted.—Native of the Cape, from whence it was introduced into the Dutch gardens, and thence into ours. It flowers, like the rest of its family, in the frame or greenhouse, about May. The *foliage* is green. *Flowers* peculiarly splendid, as large as the first species; their tube and base of the limb yellow; middle of the limb marked with an angular, or arrow-shaped, dark purple, or chocolate-coloured, spot; all beyond it of an orange scarlet. The sheaths are wrinkled, furrowed, brown, copiously dotted with a darker tint.

4. *S. galeata*. Hooded Flesh-coloured Sparaxis. Ker n. 4. (*Gladiolus galeatus*; Jacq. Coll. v. 4. 167. Ic. Rar. t. 258. Willd. Sp. Pl. v. 1. 212, excluding most of the synonyms.)—Corolla irregular; its upper segment spreading. Leaves elliptic-oblong.—Native of the Cape: cultivated by Jacquin. The *stem* is leafy, a span high. *Leaves* equitant, vertical, broad, many-ribbed, and obtuse. *Flowers* about three, flesh-coloured or pale purplish; the lower lip yellow: the upper segment, or hood, is remarkably divaricated. Perhaps the irregularity of the corolla would rather authorize the referring this and the following, as most authors have done, to *Gladiolus*, near our fourth species of that genus. See GLADIOLUS.

5. *S. bicolor*. Purple and Yellow Sparaxis. Ker n. 5. Ait. n. 2. (*Ixia bicolor*; Ker in Curt. Mag. t. 348. *Gladiolus bicolor*; Thunb. Diss. n. 16. t. 2. f. 1. Willd. Sp. Pl. v. 1. 216. Jacq. Ic. Rar. t. 240.)—Corolla irregular; its segments converging. Leaves lanceolate.—From the same country.

country. Introduced at Kew in 1786, by Mr. Mallon. The *leaves* are narrower, and more acute, than in the last. *Flowers* three or four, with spotted *sheaths*; their tube, and two lateral segments, pale yellow, or whitish; hood purple; lip deep yellow.

6. *S. grandiflora*. Large-flowered Sparaxis. Ker n. 6. Ait. n. 2. (*Ixia grandiflora*; De la Roche Diff. 23. Curt. Mag. t. 541. Redout. Liliac. t. 139. *I. aristata*; Thunb. Diff. n. 15. Ait. ed. 1. v. 1. 57. Willd. Sp. Pl. v. 1. 203. Andr. Repof. t. 87. *I. foliis gladiolatis*, &c.; Mill. Ic. t. 237. f. 3. *I. uniflora*; Jacq. Ic. Rar. t. 283. *I. holosericea*; Jacq. Hort. Schoenbr. v. 1. 9. t. 17.)

β. Curt. Mag. t. 779.

Corolla regular; its segments obovate-oblong, four times the length of the tube. Stamens and style inclining. Sheath with many awl-shaped segments. Leaves erect, lanceolate.—Native of the Cape. Long since cultivated in the gardens of Europe. The *stem* is about a foot high, bearing usually three or four handsome *flowers*; sometimes but one. *Leaves* equitant, scarcely glaucous, usually much shorter than the stem. *Sheaths* striated, ending in many lax taper segments, of their own length. *Corolla* full two inches wide; usually of a rich deep satin-like purple, edged with white, and paler beneath; but in the variety β, it is whitish, or sulphur-coloured, with some central spots, on the upper side; violet beneath. It must be allowed that authors have multiplied figures of this species in a most blameable manner.

7. *S. bulbifera*. Bulb-bearing Sparaxis. Ker n. 7. Ait. n. 4. (*Ixia bulbifera*; Linn. Sp. Pl. 51. Willd. Sp. Pl. v. 1. 204. Andr. Repof. t. 48. Curt. Mag. t. 545. Redout. Liliac. t. 128. *Ixia foliis linearibus glabris*, caule foliolo bulbifero; Mill. Ic. t. 236. f. 2.)—Corolla regular; its segments elliptical, acute, four times the length of the tube. Stamens inclining. Sheath deeply torn. Leaves erect, lanceolate. Stem bulbiferous, somewhat branched.—From the same country as the last, and known as long in our gardens. It is taller than that species, with paler *leaves*. The *stem* is generally branched and leafy, bearing a few bulbs at each joint, by which the plant may be increased. Each branch usually bears two distant *flowers*, rather smaller than the foregoing, but with the same silky aspect, though their colour is a uniform pale yellow, or white; and their segments are more acute.

8. *S. fimbriata*. Fringed Sparaxis. Ker n. 8. (*Ixia fimbriata*; Lamarek Dict. v. 3. 339. *I. foliis gladiolatis nervosis*, &c.; Mill. Ic. t. 237. f. 1, 2.)—Corolla regular; its segments elliptical, obtuse, four times as long as the tube. Stamens erect? Sheath deeply torn. Leaves erect, bluntish, about as tall as the simple, zigzag, three-flowered stem.—Native of the Cape of Good Hope. Cultivated by Miller. We adopt this species, (though omitted by Mr. Dryander in Ait. Hort. Kew.) on the authority of the authors quoted, for we have had no opportunity of investigating it. Its humble growth, and the abruptness of the *leaves*, seem to indicate a specific difference from the two last. The *stem* bears no bulbs, and is quite simple; leafy at the base only. *Flowers* large; white or yellowish above; tinged with violet beneath. Miller represents both *style* and *stamens* erect, but we dare not implicitly rely on this. The *sheaths* are split into numerous very long and slender segments.

Mr. Ker merely mentions an eighth species, under the name of *S. lacera*, seen by him in sir Joseph Banks's herbarium, with which we are unacquainted.

SPARENBERG, in *Geography*, a town and citadel of Westphalia, in the county of Ravensberg; 2 miles S.E. of Bielefeld.

SPARGANIUM, in *Botany*, *σπαργάνιον* of the Greeks,

a very expressive ancient name, derived from *σπαργάνιον*, a *fillet*, or *bandage*, and alluding to the long flat linear form, and pliant texture, of the ribband-like foliage—Linn. Gen. 480. Schreb. 621. Willd. Sp. Pl. v. 4. 199. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 961. Ait. Hort. Kew. v. 5. 235. Brown Prodr. Nov. Holl. v. 1. 338. Pursh v. 1. 33. Juss. 26. Tourn. t. 302. Lamarek Illustr. t. 748. Leers Herborn. t. 13. f. 11. Gærtn. t. 19.—Class and order, *Monocotyledonia*. Nat. Ord. *Calamaria*, or rather *Piperite*, Linn. *Typha*, Juss.

Gen. Ch. Male flowers numerous, collected into a head. *Cal.* Perianth of three linear, coloured, erect, deciduous leaves. *Cor.* none. *Stam.* Filaments three, capillary, longer than the calyx; anthers oblong.

Female, *Cal.* as in the male. *Cor.* none. *Pist.* Germen ovate, tapering into a short awl-shaped style; stigma oblique, undivided, downy, channelled along the upper side, permanent, usually simple, rarely double. *Peric.* Drupa dry, turbinate, pointed; angular at the base. *Seed.* Nut hard, oblong-ovate, angular, usually solitary; occasionally there are two.

Eff. Ch. Male, Calyx of three leaves. Corolla none. Female, Calyx of three leaves. Corolla none. Drupa dry, with a solitary nut.

1. *S. ramosum*. Branched Bur-reed. Hudf. 401. Fl. Brit. n. 1. Willd. n. 1. Pursh n. 1. Curt. Lond. fasc. 5. t. 66. Engl. Bot. t. 744. Bauh. Theatr. 228. Ger. Em. 45. (*S. erectum*; Linn. Sp. Pl. 1378.)—Leaves triangular at the base; concave at the sides. Common flower-stalk branched. Stigma linear.—Common in ditches, and about the banks of ponds and rivers, throughout Europe; more rare, according to Mr. Pursh, in North America. It appears to be the *σπαργάνιον* of Dioscorides, being the only species Dr. Sibthorp observed in Greece. It is perennial, flowering in July and August. *Root* creeping. *Stem* erect, about a yard high, round, leafy, smooth, alternately branched at the top in a paniced manner. *Radical leaves* triangular at the base, with concave sides; their upper part erect, sword-shaped, smooth, much taller than the stem; *stem-leaves* gradually shorter, flat, clasping at their base. *Partial flower-stalks* racemose, many-flowered; zigzag in the lower part. *Heads* alternate, sessile, globose; the lower ones female, brown; upper male, closer and more numerous, with yellow *anthers*. *Calyx-leaves* spatulate, brown. *Germen* of two cells. *Stigma* elongated, linear, usually solitary; when there are two stigmas, there seem to be two seeds also. The *Sparganium* of Morison, sect. 8. t. 13. f. 2, seems an *Alisma* or *Sagittaria*.

2. *S. simplex*. Unbranched Upright Bur-reed. Hudf. 401. Fl. Brit. n. 2. Willd. n. 2. Pursh n. 2. Curt. Lond. fasc. 5. t. 67. Engl. Bot. t. 745. (*S. erectum* β; Linn. Sp. Pl. 1378. S. n. 345.* Linn. Fl. Lapp. ed. 1. 271. ed. 2. 280. *S. non ramosum*; Bauh. Theatr. 231. *S. latifolium*; Ger. Em. 45. *S. alterum*; Bauh. Hist. v. 2. 541. Lob. Ic. 80.)—Leaves triangular at the base; flat at the sides. Common flower-stalk simple. Stigma linear.—Native of ponds throughout Europe, especially on a gravelly soil, flowering in July and August. More frequent in North America, according to Mr. Pursh, than the *ramosum*, from which Hudson and Curtis first well distinguished this species. It is a smaller plant, and never branched or paniced. The lowermost head of *flowers* is generally stalked; the rest being sessile. *Calyx* green, or whitish, not brown. *Stigma* elongated, mostly simple.

3. *S. natans*. Floating Bur-reed. Linn. Sp. Pl. 1378. Willd. n. 3. Fl. Brit. n. 3. Pursh n. 3. Engl. Bot. t. 273. Fl. Dan. t. 260.—Leaves drooping, flat. Com-

mon flower-stalk simple. Stigma ovate, very short. Head of male flowers nearly solitary.—Native of rivers, pools, and lakes, in Europe and North America, chiefly on a muddy or clay soil, flowering in July. The root is long, perennial, creeping widely. Herb floating, with long flat leaves, half the size of the last; the upper ones sheathing. Cluster of few heads of flowers, of which the top one only, with sometimes a portion of the next, is male; the lowermost is stalked. The short, broad, ovate, always solitary, stigma best distinguishes this from *S. simplex*. Willdenow persists in citing the *Fl. Lapp.* for this, though he refers to it properly under the preceding, except that in both cases he omits the asterisk.

4. *S. angustifolium*. Narrow-leaved Bur-reed. Br. n. 1. (*S. angustifolium*; Michaux Boreal-Amer. v. 2. 189? *S. natans* β; Pursh n. 3?)—"Leaves flat, lax, longer than the stem. Heads of male flowers numerous. Stigma oval. Drupa obovate, even; depressed at the summit."—Found by Mr. Brown near Port Jackson, New South Wales. If the synonyms be right, it is also a native of rivulets in Canada.

SPARGANOPHORUS, from *σπαργανον*, a fillet, and *φειω*, to bear, because the seed is crowned with a membranous band, or border.—Vail. Act. Paris. ann. 1719. Gært. v. 2. 395. t. 165. Michaux Boreal-Amer. v. 2. 95. Pursh v. 2. 518.—We have already spoken of the plant of Vaillant and Gærtner under ETHULIA, (see that article,) of which, in our opinion, it constitutes a genuine species. Perhaps that of Michaux and Pursh may belong to the same genus, but we dare not, without examination, assert this. The word *Sparganophorus*, though not exactly compounded of *Sparganium*, may be thought rather too near to that name, and we, on many accounts, prefer *Ethulia*.

SPARGANOSIS, from *σπαργω*, to swell, in Surgery, an abscess of the breast; a milk-abscess.

SPARGUS, in Ichthyology, a name given by Gaza to the common sparus, which he calls also *fluta*.

Artedi calls it the plain yellow sparus, with an annular spot near the tail. See SPARUS.

SPARHAWK POINT, in Geography, a cape on the north coast of the mouth of the river Piscataqua.

SPARKS'S ISLAND, a small island in the bay of Honduras, at the mouth of the river Roman. N. lat. 15° 54'. W. long. 86° 5'.

SPARLING, in Ichthyology. See SMELT.

SPARLING-FOWL, in Ornithology, a name given in some places, by the country people, to the female merganser, called more usually the *dundiver*.

SPARNECK, in Geography, a town of Germany, in the principality of Culmbach; 3 miles S.S.E. of Munchberg.

SPARRE, ERIC, in Biography, chancellor of Sweden, was born in 1550; but from this time we have no account of him till 1578, when he was appointed supreme judge of Westmanland and Dalecarlia; and in 1582 he became a senator, governor of these provinces, and vice-chancellor of the kingdom. In 1583 he was knighted by king James VI. of Scotland; and in 1587 he went as envoy to Poland, respecting the elevation of Sigismund to the Polish throne. Within about two years from this time he fell in disgrace, was deprived of his employments, and thrown into prison. He was likewise accused of high crimes against the sovereign, John III. On this occasion his letter of knighthood was taken from him by the king, and torn to pieces before his face. He was, however, pardoned, on the intercession of king Sigismund; but was again arraigned, in 1592, before a court at which the king himself presided, on a charge

of having promised the cession of Esthonia, in direct contradiction to the instructions which he had received, when envoy of Poland. He defended himself with great boldness against all his accusers; which so incensed the sovereign, that he drew his sword, exclaiming, that it was given him by God to punish traitors and breakers of their oath. Duke Charles brought forth other accusations against him; but the court broke up, after coming to this conclusion, that Sparre, and the other senators who had been accused with him, were neither condemned nor acquitted. Sparre fell again under the duke's displeasure, on account of a celebrated book which he wrote, entitled "Pro Lege, Rege, et Grege;" which seemed to be directed against the authority exercised by that prince. Having, however, taken an oath of fidelity to the duke, and made a solemn promise of obedience in writing, he was restored to his employments; and, as chancellor of the kingdom, subscribed, in 1593, the reconciliation between him and Sigismund. Notwithstanding this, he was afterwards delivered up to the duke, and suffered under the hands of the executioner, during the bloody scenes that took place at Linköping, in 1600; but he maintained his innocence to the last, and read a protest against those who had doomed him to punishment. He was author of many books, besides the one already referred to, "Pro Lege," &c. among which are the following: "Account of the Coronation of king Sigismund at Upsal, February 19, 1594;" "Sententia Ordinum Regni Sueciæ in quosdam de Collegio Senatorum," &c.; "Adversus Infimulationes et Protestationes à Regis Sigismundi legato Polono, Oratione prolata, Defensio." Gen. Biog.

SPARRING, among Cock-fighters, is the fighting a cock with another to breathe him. In sparring, they put hots on their spurs, that they may not hurt one another.

To spar the cock, imports in general to breathe him, in order to embolden him to fight. See HORTS.

SPARRMANNIA, in Botany, so named by the younger Linnæus, in honour of his distinguished countryman, Andrew Sparrmann, or rather Sparman, the friend and pupil of his father, and the companion of the voyage of the Forsters, round the world. This gentleman is well known in England by the account of his travels in southern Africa, which display great candour and love of truth, as well as the true spirit of Linnæan philosophy and accuracy. He is, we believe, still living in Sweden.—Linn. Suppl. 41. Schreb. 355. Willd. Sp. Pl. v. 2. 1160. Thunb. Nov. Gen. 88. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 3. 298. Juss. 290. Lamarek Illustr. t. 468.—Clas and order, *Polyandria Monogynia*. Nat. Ord. *Columnifera*, Linn. *Tiliaceæ*, Juss.

Gen. Ch. Cal. Perianth inferior, of four lanceolate, undivided, spreading, nearly equal, deciduous leaves. Cor. Petals four, equal, wedge-shaped, flat, undivided, twice the length of the calyx. Nectary? of several thread-shaped, tumid, corrugated, or toothed, bodies, more properly to be esteemed imperfect filaments, or stamens, partly changed to petals. Stam. Filaments numerous, thread-shaped, inserted into the receptacle, about half the length of the petals; anthers ovate, incumbent. Pist. Germen superior, roundish, hispid, with five angles; style thread-shaped, longer than the stamens; stigma in many minute segments. Peric. Capsule five-sided, with five cells; its angles armed with long, straight, rigid, spreading thorns, each tipped with a sharp transparent point. Seeds two in each cell, oblong, smooth, keeled at one side.

Ess. Ch. Calyx of four leaves, deciduous. Petals four. Barren filaments numerous, toothed. Capsule of five cells, angular,

angular, armed with straight pungent spines. Seeds two in each cell.

Obf. Ventenat has justly remarked that the supposed nectaries are, as well as the perfect stamens, inserted into the receptacle, and not, as Schreber after Thunberg asserts, into the germen, and that they are properly to be considered as imperfect stamens.

1. *S. africana*. African Sparmannia. Linn. Suppl. 265. Willd. n. 1. Ait. n. 1. Retz. Obf. fasc. 5. 25. t. 3, (but the synonym, habitat, and all that follows, belong to the preceding *Lagerstromia*.) Curt. Mag. t. 516. Venten. Malmaif. t. 78.—Native of woods and thickets, on the sides of hills, at the Cape of Good Hope, flowering from October to January. It was introduced at Kew, in 1790, by Mr. Masson, and makes a most elegant and splendid appearance in the collection of greenhouse shrubs, in the spring, and early part of the summer. The whole plant is clothed with fine, silky, spreading hairs. *Stem* shrubby, erect, two to six feet high, with round, alternate, leafy branches. *Leaves* alternate, stalked, dependent, large, heart-shaped, pointed, crenate, slightly lobed, veiny, resembling those of some Mallow, *Sida*, or *Hibiscus*. *Stipulas* awl-shaped, lateral, in pairs near the base of each *footstalk*. *Flowers* in large, terminal, hairy umbels, like those of a Cape Geranium, with awl-shaped *bractees*. *Calyx* downy, pale brown, not quite an inch long. *Petals* white, wrinkled, often emarginate. *Filaments* yellow, partly crimson. *Anthers* brown. This shrub is propagated, without much difficulty, either by cuttings or seeds; but we know not whether the latter are often perfected in Europe.

SPARROW, PASSER, in *Ornithology*, the name of a large order of birds. See PASSERES.

SPARROW, *Common*, or *Houfe*, the *Fringilla domestica* of Linnæus, is a well-known bird, and needs no description. Sparrows are proverbially falacious; they breed early in the spring, often in the nests of the martin, after expelling the owner; the martin, however, in revenge, is said to assemble its companions, and to assist in plastering up the entrance with dirt, and thus leaves the invader to perish. See FRINGILLA.

SPARROW, *Hedge*, *Curruca*, or *Motacilla modularis* of Linnæus, a bird of the size of the red-breast, or of the titlark. Its beak is longish, slender, and black; its head is of a deep brown, mixed with ash-colour; the cheeks are marked with oblong spots of dirty white; the back and coverts of the wings are dusky, edged with reddish-brown; the quill-feathers and tail dusky; the rump brown, tinged with green; the throat and breast are of a dull ash-colour; the belly of a dirty white; the sides, thighs, and vent-feathers are of a pale tawny brown; and the legs of a dull flesh-colour. This bird frequents low hedges, particularly those of gardens; making its nest in some small bush, where it lays four or five eggs of a fine pale blue colour; and during the breeding-season it has a remarkable flirt with its wings. The male has a short but very sweet plaintive note, which it begins with the first frosty mornings, and continues till a little time in the spring.

The bird which Linnæus supposes to be our hedge-sparrow, which he describes under the title of *motacilla curruca*, and to which he applies the denomination of *cannavarola*, differs in colour of plumage as well as eggs. Pennant.

It is in the nest of this bird that the cuckoo hatches her eggs for the most part, though not always, the nests of turtle and wood-pigeons being sometimes used by her for that purpose. Hence it was that the ancients made the cuckoo an emblem of such men as made bold with the mar-

riage-bed of others, who, on that account, were called *currucæ*. See MOTACILLA.

SPARROW, *Reed*, *Passer arundinaceus*, the *Emberiza seboenicus* of Linnæus, a bird that lives most commonly among reeds in marshy places, and known among authors by the name of *junco*.

Its nest is curiously contrived, being fastened to four reeds, and suspended by them like a hammock, about three feet above the water. It lays four or five eggs of a blueish-white, marked with irregular purplish veins. This bird is much admired for its song, and like the nightingale it sings in the night. In the male, the head, chin, and throat, are black; the tongue livid; at each corner of the mouth commences a white ring, which encircles the head; at approach of winter the head changes to hoary, but on return of spring resumes its jet colour; the whole under side of the body is white; the back, coverts of the wings, and the scapular feathers, are black, deeply bordered with red; the two middle feathers of the tail are of the same colours, the three next black; the exterior web, and part of the interior of the outmost feather, are white: the head of the female is rust-coloured, spotted with black; it wants the white ring round the neck, but in most other respects resembles the male. Pennant. See EMBERIZA.

SPARROW, *Lesser Reed*, *Willow Lark*, or *Sedge-bird*, *Passer arundinaceus minor*, the *Motacilla faliaria* of Linnæus, is a species of a slender elegant form; the head brown, marked with dusky streaks; over each eye a line of pure white, over that another of black; cheeks brown; throat, breast, and belly white, the two last tinged with yellow; hind-part of the neck and back of a reddish-brown; the back spotted with black; coverts of the tail tawny; coverts of the wings dusky, edged with pale brown; quill-feathers dusky; tail brown, and in the form of a wedge, and making a circle when spread, and legs dusky. This bird is common in low wet grounds, sits on the top of some spray with its wings dishevelled; its song consists of but two notes, which are loud, querulous, and harsh. Pennant.

Ray observes, that the lesser reed sparrow sings sweetly, and some have called it *cannavarola*. See MOTACILLA.

SPARROW, *Solitary*. See PASSER Solitarius.

SPARROW, *Tree*, *Passer montanus*, the *Fringilla montana* of Linnæus, is inferior in size to the common sparrow; the bill is thick and black; the crown of the head, hind part of the neck, and lesser coverts of the wings, are of a bright bay, the two first plain, the last spotted with black; the chin black; the cheeks and sides of the head white, marked with a great black spot beneath each ear; the breast and belly of a dirty white; just above the greater coverts is a row of feathers, black edged with white; the greater coverts are black, edged with a rust-colour; the quill-feathers dusky, edged with pale red; lower part of the back of an olive-brown; the tail brown, and legs of a straw-colour.

These birds are common in Lincolnshire, among trees, and collect, like the common kind, in great flocks. Pennant. See FRINGILLA.

SPARROW, *Water*, *Passer aquaticus*, a bird described by Nieremberg, which, he says, the Indians call *acotolequichitl*. It sings all day long without ceasing, but with no very pleasing note. It is, however, a well-tasted bird. It lives among sedge and bushes, and is of the size and shape of a swallow, but has a black bill and yellow legs; its breast and belly are white, and its back is of a brownish-yellow, variegated with spots of black and white. This bird much resembles our reed sparrow. Ray.

SPARROW, in *Agriculture*, a mischievous destructive bird in corn-fields, and which should mostly be destroyed. It

is observed, that were all the farmers in a neighbourhood to agree to their destruction, by offering rewards for their heads, their numbers might be lessened; and that were the practice general, surely the whole race might be extirpated. It is supposed, that sixpence a dozen the first year, nine-pence the second, and a shilling the third year, would nearly reach their complete extirpation. To enforce which, it should be considered how soon twelve sparrows destroy twelve penny-worth of wheat.

In Kent, they use a species of trap, which is very effectual in taking them. It, according to Mr. Marshall, consists of a small wicker basket, resembling the fruit-sieve of the London markets, with a cover of the same material fitted to it, and formed on the principle of the fish-pot, and the vermin trap, into which the entrance is easy, but the return difficult. These traps, which are an ordinary article of sale in the markets of the district, are constituted of brown unpeeled osiers. The diameter about two feet; the depth nine inches; the cover is somewhat dishing, with a tunnel, or inverted cone, in the centre, reaching to within an inch of the bottom of the basket; the aperture or entrance, formed by the points of the twigs, of which the tunnel is constructed, being about an inch and a half in diameter. And the usual bait is wheat scattered in the basket. The number caught at once, is frequently more than theory would suggest; the contentions of a few that have entered, seldom failing to bring others to the combat.

These mischievous birds, however, soon grow too cunning to be taken in any sort of trap to any extent, which has a chance of extirpating and destroying the race; consequently some more effectual and certain plan, such as that suggested above, or some other, which is better and more fully adapted to the purpose, must be had recourse to in order to completely exterminate them, and prevent the injury they do annually to the farmer, in the destruction of his wheat and other crops. Though these are only small birds, they destroy vast quantities of grain, much more than has indeed been commonly supposed. It is stated to have been calculated to have amounted to a hundred facks of wheat, besides the oats and barley, in the course of only one season, in a township of no very great extent in the north-western part of the kingdom. Where rewards or sums of money are paid for the taking or destroying them, no advantages are gained, except where there are sufficiently ample and proper regulations entered into and enforced, the whole district, parish, or township becoming partakers in the business. No languid or half measures will do any thing useful, or to the purpose, in this sort of undertaking.

It is not improbable, but that these destructive birds might be greatly extirpated and thinned down in their numbers, by the use of some tasteless infusion of a strongly poisonous nature, either to the ears of the grain at the time of harvest, or to the naked grain in the winter season, when they are extremely eager for food, as they are constantly found to remain hovering about houses or other buildings, where the effects of such trials might easily be ascertained. If such a method should succeed, the whole race might readily, and with great facility and certainty, be exterminated.

SPARROW-Grass, in *Botany*. See ASPARAGUS.

SPARROW-Hawk. See HAWK.

SPARROW-Wort, in *Botany*. See PASSERINA.

SPARRY, in *Mineralogy*, having a confused crystalline structure, synonymous with spathose.

SPARRY Iron Ore, denominated also *brown spar* and

pearl spar, is a mineral composed of the oxyd of iron combined with about thirty-five *per cent.* of carbonic acid, and a variable portion of manganese, lime, and magnesia. (See IRON ORES.) As *pearl spar*, this mineral may be classed among the earthy minerals. It has a white colour, passing by various gradations into brown, with a pearly lustre; in the pure white specimens the lustre is brilliant. It occurs in small curved rhomboidal crystals, which do not melt before the blow-pipe, but dissolve with effervescence in muriatic acid. This mineral is generally found in veins, accompanying metallic ores, but is never worked as an ore of iron.

SPARS, in *Rural Economy*, a name often applied to thatching rods, or the spels or rods by which thatch is bound on the roofs of buildings.

SPARS, in *Ship-Building*, small fir-trees; called *cant*, which are from 33 to 35 feet long, and five hands circumference; *barling*, from 30 to 28 feet long, and four hands circumference; *boom*, from 24 to 20 feet long, and three hands circumference; *middling*, from 20 to 16 feet long; and *small*, from 16 to 11 feet long.

SPARSE-LEAVES, *Sparfa folia*, among *Botanists*. See LEAF.

SPARTA, in *Ancient Geography*, a celebrated city of Greece, in the Peloponnesus, and the capital of Laconia. It was situated at the foot of mount Thernax, on the banks of the Eurotas, and to the W. of it.

According to Strabo, this city was founded by Patrocles; but the most common opinion attributes its origin to Leles, in the year 1516 B.C. Some maintain that it originated at Lacedæmon in the year 400 B.C. However this may be, it was known also by this name. However, the appellation of Spartans is applied to the inhabitants of Sparta and its territory, and that of Lacedæmonians to the inhabitants of the whole country of Laconia. (See LACONIA, and LACEDÆMONIANS.) This country was not equal in extent to Athens, containing only 48 *stadia*; but it was adorned in a very eminent degree. At first it had no walls, the Spartans confiding in their own valour for its defence. In process of time, however, they constructed walls about it, when the ambition of Cassander, and the violent assaults of some tyrants, had wearied out and almost exhausted their fortitude. Pausanias says, that it was fortified on occasion of the wars of Demetrius and Pyrrhus, and he mentions in terms of high commendation some pieces of sculpture, for which this city was distinguished. Sparta was famous for a variety of public institutions, among which were the senate of the aged, the senate of the conservators of the laws, the senate of the ephori, and that of the magistrates, denominated *Bidæans*. The first of these was the sovereign tribunal of the Lacedæmonians, which regulated the affairs of the state; the other senators were, properly speaking, archons; the ephori were five, and the *Bidæans* of the same number, whose province it was to direct and superintend the exercises of the youth. The public edifices, temples, statues, and monuments of Sparta, were so numerous and various, that we should far exceed our limits in recounting them. It is not certain at what time this celebrated place was destroyed; but it was succeeded by the modern town of Mistra, which is situated about four miles from ancient Sparta.

SPARTA was also the name of a town situated in the environs of the Euxine sea. Steph. Byz.

SPARTA, in *Geography*, a post-town of America, in Sparta county, North Carolina; 541 miles from Washington.—Also, a post-town of New Jersey, in Suflex county; 117 miles from Philadelphia.—Also, a post-town of Han-

cock county, Georgia, with a court-house and gaol, situated in a fertile and populous country, and a place of considerable trade.

SPARTA, a post-township of New York, in the S.W. corner of Ontario county, 25 miles S.W. of Conondaigua; bounded N. by Genesee and Livonia, E. by Livonia and Naples, S. by Steuben and Allegany counties, and W. by Genesee county. It comprises three townships. The alluvial lands are fine, and the territory is in general good and well settled, principally by emigrants from Pennsylvania. Hemp is raised in considerable quantities. In 1810 the whole population was 1397, with 65 senatorial electors; and the household looms, of which there are 56, produced 17,772 yards of cloth. The whole number of families is 232.

SPARTACUS, in *Biography*, one of the scourges of Roman tyranny and cruelty, a native of Thrace, was born of very low parents, entered the army, then became a deserter, and a robber. Being taken, he was confined as a gladiator in a receptacle at Capua for those unfortunate men whose lives were devoted to the pleasure of the Roman people. He escaped the horrid den, and placing himself at the head of a body of gladiators and fugitive slaves, he took a fortified place in the year B.C. 72, whence he made predatory excursions throughout Campania. His force daily increased, and he defeated several commanders who were sent against him. He marched into Cisalpine Gaul, in order to give the slaves in his army, who were mostly Thracians and Gauls, an opportunity of returning home. Part of them, however, greedy of pillage, separated themselves from their commander, and were cut to pieces. The consul Lentulus, upon this success, which was extremely partial, pursued Spartacus, who turned about and gave him a total defeat; and then, in his turn, becoming the aggressor, he marched against the other consul, Gellius, drove him from the field, and obliged him to take shelter in the walled towns. He retaliated the cruelty of the Romans towards the gladiators, by obliging a number of his captives to fight with each other round the funeral pyre of one of his commanders. He was now at the head of 120,000 men, and with these he ravaged most of the provinces of Italia, and struck such a terror at Rome, that Crassus, at that time the man of the greatest consequence in the city, was sent against him. He soon confined Spartacus in Lucania, and cut off some of his detachments, so that he would gladly have crossed over to Sicily, but being prevented, he took post in a peninsula near Rhegium, where Crassus enclosed him by a rampart drawn from sea to sea. Spartacus, however, found means to break through this barrier, and gain the open country, but he was here deserted by a large body of his followers, who became the victims of Crassus. Spartacus now retreated towards the mountains, and repulsed with loss some of his pursuers. This success was, however, his ruin; for his men insisted upon his return to give battle to Crassus in the open field. Before the commencement of the engagement, Spartacus stabbed his horse, exclaiming, "If I am victorious, I can easily get another; if vanquished, I shall not want any." After a long contest, the Roman discipline prevailed. Spartacus, during extraordinary exertions of valour, was surrounded, and fell pierced with a multitude of wounds. He was unquestionably a brave man, and something more than a courageous barbarian. He had, says Plutarch, not only strength and elevation of mind, but a discernment and civility much superior to his fortune. It is said that his wife accompanied him into the field, pretended to the gift of prophecy, and probably inspired him with a fanatical confidence in victory.

SPARTANBURG, in *Geography*, a district of South Carolina, containing 12,122 inhabitants, of whom 147 are slaves.

SPARTEL, CAPE, a cape of Morocco, W. of Tangier, being a headland, which divides the straits from the Western ocean. After doubling this cape, at the distance of 15 miles stands the little town of *Arzilla*; which see.

SPARTIANUS, ÆLIUS, in *Biography*, a Latin historian, flourished in the time of Diocletian, to whom he dedicated the lives of Adrian, Ælius, Verus, Didius Julianus, Severus, and Pescennius Niger, which, as well as his lives of Caracalla and Geta, are come down to our times. He is one of the writers of the "Historiæ Augustæ Scriptores," but his merits are not very great.

SPARTINA, in *Botany*, a name borrowed from *Spartum*, a kind of broom, or of hard grass, both used in ancient as well as modern times, to make baskets, cordage, &c.—Schreb. Gen. 43.—Class and order, *Triandria Monogynia*. Nat. Ord. *Gramina*.

Gen. Ch. *Cal.* Glume single-flowered, compressed, of two boat-like, compressed, keeled, converging valves; the innermost longest; the broader one striated at the back, and pointed. *Cor.* shorter than the inner valve of the calyx, of two nearly equal, linear, compressed, bluntish valves, clasping each other, the inner one rather the longest. Nectary none. *Stam.* Filaments three, capillary, very short; anthers linear, square, sharpish, cloven at the base. *Pist.* Germen superior, linear, acute; style thread-shaped, erect, longer than the stamens; stigmas two, villous. *Peric.* none, except the calyx, which enfolds the seed, and at length drops it. *Seed* oblong, compressed.

This is all the account we have found of the present genus, of which its author has left nothing concerning the species, whether one or more, nor its native country. These points can only be ascertained from his herbarium; and as yet *Spartina* has not been adopted by any writer that has fallen in our way, though it seems to have the sanction of Schrader in his *Flora Germanica*, v. 1. 169. That author, so learned in grasses, strongly objects to Roth's having referred to *Spartina* by the name of *phleoides*, the *Crypsis schœnoides* of Schrader, Lamarek, and others; as being, he says, widely different, both in habit and the structure of its flowers. *Spartina* however does not find a place in his *Flora Germanica*, and is, therefore, perhaps not of European growth.

SPARTIUM, *σπαρτίον* of Dioscorides, so called from *σπαρτήν*, a rope, because of the use of the long, slender, tough branches, or bark, in making cordage.—Linn. Gen. 368. Schreb. 487. Willd. Sp. Pl. v. 3. 926. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 4. 254. Sm. Fl. Brit. 753. Prodr. Fl. Græc. Sibth. v. 2. 53. Gærtn. t. 153. (Genista; Juss. 353. Tourn. t. 411. Lamarek Illustr. t. 619. f. 1.)—Class and order, *Diadelphia Decandria*. Nat. Ord. *Papilionaceæ*, Linn. *Leguminosæ*, Juss.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, tubular, somewhat heart-shaped; its margin at the upper side very short; at the lower furnished with five little teeth towards the extremity; coloured, small. *Cor.* papilionaceous, of five petals; standard inversely heart-shaped, very large, entirely reflexed; wings ovate-oblong, shorter than the standard, attached to the filaments; keel of two petals, lanceolate-oblong, longer than the wings, inserted into the filaments, the lower edges of its petals connected by fine hairs. *Stam.* Filaments ten, combined all together at the base, adhering to the germen, unequal, gradually longer; the upper one very short, the remaining nine in one set; anthers rather oblong. *Pist.* Germen oblong, or roundish; style awl-shaped,

shaped, ascending; stigma united to the upper side of its summit, oblong, villous. *Peric.* Legume cylindrical, long, obtuse, of one cell and two valves. *Seeds* several, kidney-shaped, somewhat globose.

Eff. Ch. Stigma longitudinal, villous above. Filaments monadelphous, adhering to the germen. Calyx extended downward.

The Linnæan genus of *Spartium* is, by Jussieu, sunk, partly in *Genista*, after Tournefort, and partly in *Cytisus*. The species in the fourteenth edition of *Syst. Veg.* are sixteen; Willdenow has twenty-five; three of the Linnæan ones being referred to Thunberg's *Lebeckia*. They are all shrubby, with yellow, rarely white, still more rarely purplish, flowers, and either simple or ternate leaves. One only is a native of Britain, though all the rest are of European growth; sixteen are enumerated amongst our garden plants by Mr. Aiton; some of them bearing the open air, others requiring the shelter of a greenhouse; but none of them very tender. As some of the others promise to be well worthy the notice of cultivators, and are easily propagated, we shall take a brief view of the whole, introducing one nondescript species, and offering a few corrections respecting some of the rest.

Section 1. *Leaves simple.*

1. *S. junceum*. Spanish Broom. Linn. Sp. Pl. 995. Willd. n. 1. Ait. n. 1. Curt. Mag. t. 85. Sm. Fl. Græc. Sibth. t. 671, unpublished. (*S. macrolobium*; *Renalm. Spec.* 34. t. 35. *Genista hispanica*; *Ger. Em.* 1313. *Genista*; *Matth. Valgr. v. 2.* 574.)—Branches opposite, round, flowering at the extremity. Leaves lanceolate. Legume linear.—Native of the south of Europe. Frequent, according to Dr. Sibthorp, on dry hills throughout Greece and the Archipelago, where it is known by the name of *σπάγιο*, being unquestionably the *σπαγιον* of Dioscorides. This shrub was one of the first exotics introduced into cultivation in England, where it is quite hardy, flowering most part of the summer, and much esteemed for the beauty, and sweet luscious scent, of its large yellow blossoms. Its height is usually six feet or more, and the copious, long, twiggy, tough branches, bearing a few elliptic-oblong leaves, make a singular appearance. The flowers are sometimes double, but are not improved in beauty by that change.

2. *S. aphyllum*. Leafless Siberian Broom. Linn. Suppl. 320. Willd. n. 2. Pallas Voyage, v. 3. append. 742. t. V. f. 2.—Branches round, straight, wand-like, smooth, subtended by very short, linear-lanceolate, close-pressed, withering leaves. Petals all smooth. Legume ovate, with two seeds.—Found by Pallas in blowing sand of the deserts about the river Wolga, flowering in June. The stems, though shrubby and often six feet high, die down every year. They are slender and much branched, with a small, inconspicuous leaf under each branch. Flowers scattered along the ultimate branches, solitary, on short stalks, small, dull violet; yellowish at the base. Legume a quarter of an inch long, gibbous, compressed, silky, as well as the calyx, flower-stalks, and young branches.

3. *S. monospermum*. White single-seeded Broom. Linn. Sp. Pl. 995. Willd. n. 3. Ait. n. 2. Curt. Mag. t. 683. (*Pseudo-spartium album aphyllum*; *Ger. Em.* 1318.)—Branches round, furrowed. Clusters lateral, of a few rather crowded flowers. Seeds solitary. Leaves lanceolate, silky, as well as the wings and keel.—Native of dry barren hills in Spain, Portugal, and Morocco. A hardy greenhouse plant with us, flowering in June and July. The stem is five or six feet high, with numerous slender, pliant, glaucous, furrowed branches, bearing, while young only, a few simple,

linear-lanceolate, obtuse, silky leaves. Flowers in short, lateral, dense clusters, white, with a dark-red smooth calyx. The standard is streaked minutely with crimson, and silky at the back, about half an inch long. Wings and keel partly, but densely, silky. Seed solitary.

4. *S. sphaerocarpum*. Yellow single-seeded Broom. Linn. Mant. 571. Willd. n. 4. Ait. n. 3. (*S. hyposphærolobium*; *Renalm. Spec.* 35. t. 33. *Pseudo-spartium hispanicum aphyllum*; *Ger. Em.* 1318.)—Branches round, furrowed. Clusters lateral, many-flowered, solitary or in pairs. Seeds solitary. Leaves lanceolate, downy beneath. Wings smooth. Keel somewhat silky.—Native of the south of Europe. A greenhouse plant, cultivated in Miller's time, flowering in June and July. Of more humble growth than the preceding, with more erect, straighter branches, and yellow flowers, not half so large, though more numerous in each cluster. Though the two plants are very distinct, their specific definition is not easy. We agree with Mr. Curtis, as to the probability of Clusius's wooden cuts, and consequently those of Gerard above cited, (which are the same blocks as those of Clusius,) being transposed. Yet we cannot say they are so, for though the inflorescence of Gerard's f. 1, applied to this yellow species, is more like the former, and *vice versa*; the size of the flowers in f. 2 is too large for the present.

5. *S. trifpermum*. Yellow Three-seeded Broom.—Branches round, striated, racemose. Leaves very short, spinous-pointed. Wings smooth. Keel silky. Legume half-ovate, with three seeds.—Gathered on mount Ætna, by the baron Bivona, from whom we, last year, received specimens. This is allied to the two last, though essentially distinct in its fruit, which more resembles that of *S. aphyllum*, n. 3, but is nearly smooth, not silky, and contains three roundish seeds. The flowers, moreover, are disposed as in that species, being loosely scattered along the young branches, not composing lateral clusters: but they are thrice as large, yellow, and fragrant, with more oblong petals, and the keel is silky, in which last character this species agrees with *sphaerocarpum*. We have not seen the young leaves, but those under the flowering branches are small, thick, short, furrowed, with a strong sharp point.—The figure of *Spartium*, *Matth. Valgr. v. 2.* 573, answers well to our plant, except that the flowers are represented much too short, and the legumes too hairy, in which latter circumstance it answers better to *S. purgans*, though, in other respects, not like that species; still less does it resemble the following.

6. *S. cinereum*. Grey-branched Broom. "Villars Prospect. 40." Willd. n. 5. (*Genista scoparia*; *Villars Dauph. v. 3.* 420. *Bellardi Append. ad Fl. Pedem.* 34.)—Branches round, with ten furrows. Leaves lanceolate; silky beneath. Flowers axillary, solitary; their stalks not longer than the calyx. Keel silky. Legume hairy.—Native of sunny hills in the south of France and in Piedmont. The branches are much more leafy than in any of the foregoing. Leaves nearly sessile, about three quarters of an inch long; smooth above. Flowers yellow, much longer than the leaves, on short silky stalks. The calyx also is silky, deeply divided. Keel silky, especially toward the lower edge. Legume hairy, with from three to five seeds. Gerard, from whom, as well as from Bellardi, we have specimens, mistook this plant, as many others have done, for *S. purgans*; but Willdenow well remarks, that the more erect and straight branches, and especially the shortness of the flower-stalks, distinguish it from that species. Villars thinks it may have been confounded with *S. scoparium*, which seems hardly possible. He conceives the figure of Matthioli, *Valgrisian edition, v. 2.* 573, badly copied in Bauhin's *Matthioli*, 852.

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f. 1, may have been done for this plant; but it more resembles our *trispermum*.

7. *S. virgatum*. Long-twig'd Broom. Ait. n. 4. Willd. n. 6. (Cytifus tener; Jacq. Coll. v. 1. 40. Ic. Rar. t. 147. Linn. Syft. Veg. ed. 14. 667.)—Branches round, furrowed. Leaves obovate, rather filky. Flowers axillary, solitary, somewhat racemose. Petals all filky. Legume densely hairy.—Found by Mr. Maffon in Madeira, whence it came to Kew garden in 1777. It is a greenhouse shrub, flowering in spring. The copious slender branches bear numerous alternate leaves, half an inch long. The flowers are yellow, very filky in every part, and form clusters at the end of each branch, two or three of the lower ones only being axillary. Legumes lanceolate, pointed, clothed with short dense hairs, and containing three or four round seeds, which are seldom all perfected.

8. *S. ramosissimum*. Branching African Broom. Desfont. Atlant. v. 2. 132. t. 178. Willd. n. 7.—Branches round, furrowed, straight. Leaves obovato-lanceolate, villous. Flowers axillary, on short stalks, somewhat whorled. Petals all filky.—Native of mount Atlas, near Tlemsen. A shrub, two or three feet high, leafless when old, flowering early in the spring. The flowers are yellow, erect. Legume not observed, but the germen is villous. Desfont.

9. *S. purgans*. Purging Broom. Willd. n. 8. Ait. n. 5. But not Linn. Syft. Nat. ed. 12. v. 2. 474. (Genista purgans; Bulliard t. 115. G. five Spartium purgans; Bauh. Hist. v. 1. p. 2. 404.)—Branches round, furrowed. Leaves obovato-lanceolate; filky beneath. Flowers axillary, solitary; their stalks thrice the length of the calyx. Petals all smooth. Legume shaggy.—Native of the south of France. We received it from the late Dr. Broussonet. The stem is woody, very much branched, and strongly furrowed, not spinous. Leaves chiefly on the young branches, small, stalked. Flower-stalks filky, as long as the leaves, or longer. Calyx partly filky. Petals yellow, shorter, and more rounded, than in *S. cinereum*, quite smooth, except the villous hairs, which knit those of the keel together. Legume curved, densely clothed with long shaggy hairs. Linnæus was really unacquainted with this species. His *Genista purgans*, Sp. Pl. 999, is a very spinous shrub, totally different from Bauhin's plant, and may be *S. scorpius*. His *S. purgans*, adopted from Gerard in the 12th edition of Syft. Nat. is our *cinereum*, n. 6; yet we do not judge it right to interchange the synonyms, merely to countenance, still less to conceal, a blunder of our great master, or of his learned correspondent, Gerard. The two plants can never again be confounded.

10. *S. umbellatum*. Umbellate Broom. Desfont. Atlant. v. 2. 133. t. 180. Willd. n. 9. Ait. n. 6.—Branches round, striated, leafy. Flowers capitate. Corolla filky, as well as the legume, and lanceolate leaves.—Native of the sea-coast of Barbary. Sent to Kew by the late Dr. Broussonet. It is a greenhouse shrub, flowering from April to June, very much branched, and readily known by its yellow, filky, capitate, rather than umbellate, flowers. Legume oblong, compressed, densely villous, containing from three to five seeds. The leaves are often ternate, so that this species ought rather to stand in the next section, near *linifolium*.

11. *S. Scorpius*. Scorpion Broom. Linn. Sp. Pl. 995. Willd. n. 10. Ait. n. 7. Prodr. Fl. Græc. n. 1644. (Genista purgans; Linn. Sp. Pl. 999? G. spinosa minor; Ger. Em. 1319. Aspalathus alter tertius; Cluf. Hist. v. 1. 106.)—Branches round, striated, spreading, spinous. Flower-stalks axillary, aggregate. Leaves oblong, hairy, with a spinous point.—Native of Spain, the south of France,

Greece, and the Archipelago. Each of the branches ends in a sharp thorn, and the young ones spread horizontally. The leaves are small, oblong or obovate, loosely covered on both sides with filky hairs. Flowers yellow, their stalks about as long as the leaves, and situated, like them, on the young branches only. We know nothing of the legume. Lamarck says it is smooth. The modern Greeks call this plant *Acôiva*.

12. *S. aspalathoides*. Tubercular Thorny Broom. Desfont. Atlant. v. 2. 136. Willd. n. 11. (Genista aspalathoides; Lamarck Dict. v. 2. 620.)—Branches angular, tuberculated, spinous. Flower-stalks axillary, aggregate. Leaves linear-lanceolate, filky, unarmed.—Discovered by Poiret, on the coast of Barbary, near Tunis. The stem is much branched, two or three feet high; the branches beset with scattered tubercles, and ending in sharp thorns. Leaves in small tufts upon the tubercles; alternate on the young shoots; small, narrow, covered with short, depressed, filky hairs. Flowers twice the size of the last, pale yellow, axillary, stalked, two or more together; their stalks, calyx, and corolla filky. Germen covered with white hairs.

Section 2. Leaves mostly ternate.

13. *S. multiflorum*. Portugal White Broom. Ait. n. 8. Willd. n. 12. (S. album; Desfont. Atlant. v. 2. 132. S. dispermum; Willd. in Rom. and Uft. Mag. fasc. 11. 35. t. 2. Genista alba; Tabern. Kreuterb. 1509.)—Leaves ternate or simple, elliptic-lanceolate, filky. Branches straight, striated, covered with flowers. Legume filky, with two seeds.—Native of Portugal and Barbary. A hardy shrub in our gardens, flowering in May. The stem is from four to six feet high, with copious, erect, long, straight, wand-like branches, covered from top to bottom with elegant, snow-white, stalked, axillary flowers. The leaves are but seldom ternate. The legume is ovate-oblong, compressed, dark brown, clothed with whitish hairs.

14. *S. angulatum*. Angular-branched Broom. Linn. Sp. Pl. 996. Willd. n. 13. Ait. n. 9. Sm. Fl. Græc. Sibth. t. 672, unpublished. (S. parviflorum; Venten. Cels. t. 87.)—Leaves mostly ternate, linear-oblong. Branches with six angles. Flowers terminal, racemose. Legume elliptical, acute at each end, with one or two seeds.—Native of the Levant. Hardy with us, flowering in May and June. Its aspect is that of a Melilot, but the stem is shrubby, with numerous straight upright branches, marked with three decurrent angles from the insertion of each leaf. The leaflets are more or less obtuse, nearly equal, slightly hoary, not an inch long. Flowers small, yellow, numerous, composing long, solitary clusters, at the end of each branch. Legumes pendulous, slightly hairy, compressed, thick-edged, three quarters of an inch long, having an annular appearance at each side from the projection of the usually solitary seed.

15. *S. persicum*. Persian Broom. Willd. n. 14. (Cytifus persicus; Burm. Ind. 163. t. 51. f. 1.)—Leaves ternate, linear-lanceolate, stalked; the middle leaflet twice as large as the others. Branches divaricated, roundish. Flowers terminal, racemose.—Native of Persia. A small species, whose genus seems uncertain, and of which neither we nor Willdenow have seen any specimen. There appears, however, some affinity between it and the last. The flowers evidently compose terminal clusters. The branches, stalks, and calyx are downy.

16. *S. patens*. Woolly-podded Broom. Linn. Syft. Veg. ed. 13. 535. Willd. n. 15. Ait. n. 10, excluding the synonym of Cavanilles. (Cytifus patens; Linn. Syft. Veg. ed. 13. 555. C. pendulinus; Linn. Suppl. 328. C. lusitanicus, medicæ folio, floribus in foliorum alis; Tourn.

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Inft. 648.)—Leaves ternate, stalked, obovate. Branches round, striated. Flowers lateral, drooping. Calyx two-lipped, broad, silky. Germen very woolly.—Native of Portugal and Spain. Hardy in our gardens, flowering in June and July. The *branches* spread widely, and are clothed with numerous, stalked, silky *leaves*, usually shorter than the large, tumid, pendulous, yellow *flowers*, which are mostly solitary, sometimes in pairs, by the side of each tuft of leaves, on simple silky stalks. The *calyx* is deeply divided, shallow, spreading widely, besprinkled with silky hairs. *Petals* very large, smooth, rounded and obtuse. *Germen* clothed with extremely long, woolly hairs, and sheathed in the permanent *stamens*, but at length becoming an oblong, compressed, wavy, very hairy *legume*, containing several *seeds*. Whatever the plant of Cavanilles' *Icones*, t. 176, may be, its unequal *leaflets*, terminal corymbose *inflorescence*, long slender *calyx*, and smooth *germen*, are all so totally unlike the present species, that we wonder how even the most casual perusal of its name could cause it to be quoted by Willdenow for such.

17. *S. nubigena*. Cluster-flowered White Broom. Ait. ed. 1. v. 3. 13. ed. 2. n. 11. Willd. n. 16. (*S. supranubium*; Masson in Linn. Suppl. 319.)—Leaves ternate, stalked, lanceolate, hairy. Branches round, furrowed. Flowers lateral, aggregate. Upper lip of the calyx abrupt. Germen smooth.—Discovered by Mr. Masson, very high on the peak of Teneriffe, above the clouds, as he meant to express in the specific name. It is a greenhouse plant at Kew, flowering most part of the summer. The bushy *stem*, with its copious furrowed *branches*, much resembles *S. junceum*, but the *leaves* are ternate, small, and the *flowers* very much smaller than in that species, white and fragrant, ranged in lateral tufts along the branches, on silky stalks. The *calyx* is hairy or silky, cup-shaped; its lower lip elongated; upper short and abrupt. *Legume* an inch and a half, or two inches long, curved, compressed, wavy, quite smooth.

18. *S. biflorum*. Two-flowered Terminal Broom. Desfont. Atlant. v. 2. 133. t. 179. Willd. n. 17.—Leaves ternate, linear-lanceolate, stalked, somewhat hairy. Flowers terminal, often in pairs. Calyx villous, its lips nearly equal. Legume smooth.—Native of mount Atlas, near Tlemcen. *Stem* bushy, from one to two feet high, with slender, angular, leafy branches. *Leaves* small, stalked, rather silky. *Flowers* yellow, erect, one, two, or three at the summit of each branch, rather smaller than those of the common *S. scoparium*.

19. *S. linifolium*. Flax-leaved Broom. Desfont. Atlant. v. 2. 134. t. 181. Willd. n. 18. Ait. n. 12. (*Genista linifolia*; Linn. Sp. Pl. 997. Curt. Mag. t. 442. *G. tinctoria hispanica*; Clus. Hist. v. 1. 101. *Genistella infectoria*; Ger. Em. 1316.)—Leaves sessile, ternate, linear-lanceolate, revolute; silky beneath. Clusters terminal. Branches angular, furrowed.—Native of Barbary, Spain, and the south of France. A hardy greenhouse plant in England, flowering most plentifully in May and June. The *stem* is shrubby, much branched, and very leafy. *Leaves* about an inch long, rendered very beautiful by the silvery silkiness of their under side, in which they agree with the *calyx* and young *branches*. *Flowers* of a beautiful golden yellow, in dense tufted clusters. *Legume* short and broad, clothed with shaggy hairs. *S. umbellatum*, n. 10, having frequently many ternate *leaves*, and agreeing nearly with the present species in habit, *legume*, and *inflorescence*, would perhaps have been better placed here.

26. *S. scoparium*. Common Broom. Linn. Sp. Pl. 996. Willd. n. 19. Fl. Brit. n. 1. Engl. Bot. t. 1339.

Curt. Lond. fasc. 5. t. 52. Woodv. Med. Bot. t. 89. Fl. Dan. t. 313. Dreves Bilderb. t. 48. Ehrh. Arb. 56. (*Genista*; Ger. Em. 1311.)—Leaves chiefly ternate, stalked, obovate. Branches angular. Flowers lateral, solitary. Calyx two-lipped, broad, smooth. Legume fringed.—Common on sandy or gravelly dry hills, principally in the north or middle of Europe. Abundant in Britain, flowering copiously in May and June, when it makes a highly ornamental appearance. The *stem* is very bushy, from three to eight feet in height, with innumerable, ascending, angular, smooth, evergreen twigs. *Leaves* deciduous, smooth or somewhat hairy; the upper ones generally simple. *Flowers* axillary, loosely pendulous, solitary, on long stalks, large, usually of a golden yellow; sometimes orange at the outside; very rarely of a pale uniform lemon-colour: their *petals* spread widely in hot sunny weather. *Calyx* bell-shaped, smooth, glaucous and purplish, with two widely-spreading lips, whose teeth are minute and downy. *Legume* compressed, two inches long, smooth, fringed at the margin with dense deciduous hairs. *Seeds* numerous.

21. *S. arboreum*. Tree Broom. Desfont. Atlant. v. 2. 131. t. 177. Willd. n. 20. (*Cytisus foliis subrotundis glabris, floribus amplis glomeratis pendulis*; Shaw Phyt. Afr. n. 191.)—Leaves ternate, stalked, obovate. Branches round, furrowed. Flowers lateral, aggregate, drooping. Calyx two-lipped, spreading. Legume silky, with close-pressed hairs.—Found by professor Desfontaines on mount Atlas, and in vallies near Algiers. From eight to twelve feet high, with a *trunk* often as thick as the arm. It seems akin to the last, but more to *S. patens*, n. 16, of which Desfontaines suspected it might be a variety. Their *foliage* indeed appears much the same, but the *flowers* of the present are more aggregate. The *legume* however seems to afford the most certain specific difference, being twice as long as that of the *patens*, and covered with depressed silky hairs, not long and shaggy ones. Nothing is mentioned of the pubescence of the *calyx*, nor have we seen a specimen: but its teeth are represented like those of *patens*, much more conspicuous than in *scoparium*.

22. *S. radiatum*. Starry Broom. Linn. Sp. Pl. 996. Willd. n. 21. Ait. n. 14. (*S. ramis oppositis angulatis, foliis oppositis subulatis*; Mill. Ic. v. 2. 173. t. 259. *S. minimum montanum triphyllum*; Column. Ecphr. 295. t. 294. f. 2. *Genista radiata, sive stellaris*; Bauh. Hist. v. 1. p. 2. 399.)—Leaves ternate, opposite, linear; with short, dilated, permanent footstalks. Branches opposite or aggregate, angular. Clusters capitate, terminal. Legume ovate, hairy.—Native of Italy and Carniola. Hardy with us, in mild winters at least. Flowering in June and July. The great abundance of naked radiating *branches*, crowned with tufts of handsome yellow *flowers*, readily distinguish this species. The broad, short, permanent, concave *footstalks*, hardening into spinous-tipped scales, under the branches, are very remarkable. The linear silky *leaves*, being opposite and ternate, look as if whorled. The *calyx* is tubular, silky as well as the *keel*. *Legume* short, broadly ovate, pointed, covered with long silky hairs, and containing several small *seeds*.

23. *S. ferox*. Sharp-thorned Broom. Desfont. Atlant. v. 2. 136. t. 182. Willd. n. 22. Ait. n. 15. (*Cytisus foliis oblongis sessilibus glabris, siliquis compressis incanis*; Shaw Phyt. Afric. n. 194.)—Leaves partly ternate, elliptic-oblong, pointed. Branches striated, with spinous points. Clusters terminal. Legume linear, hoary.—Native of Barbary. The *stem* is three or four feet high, with numerous straight leafy *branches*, which, after bearing each a terminal *spike*,

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spike, or *cluster*, of yellow *flowers*, become very sharp thorns. The *leaves* are most of them simple, on short stalks, nearly smooth; some of the lower ones ternate. *Corolla* smooth, oblong and slender, somewhat like *Genista tinctoria*. *Calyx* elongated. *Germen* silvery. *Legume* about an inch and a half long, linear, slightly curved, clothed with short, compressed, hoary hairs. *Seeds* numerous.

24. *S. spinosum*. Prickly Broom. Linn. Sp. Pl. 997. Willd. n. 23. Ait. n. 16. Desfont. Atlant. v. 2. 135. (*Acacia altera* Dioscoridis; Lob. Ic. v. 2. 95. *A. altera trifolia*; Ger. Em. 1330. *A. altera*; Matth. Valgr. v. 1. 176.)—Leaves ternate, stalked, obovate. Flowers axillary. *Calyx* smooth. Branches striated, with alternate, spreading, angular, furrowed thorns. *Legume* oblong, smooth.—Native of Italy, Spain, and Barbary. Gerard appears to have cultivated it in 1596, and it is marked by Mr. Aiton, as a greenhouse shrub, flowering in June and July; but we have seldom met with it in collections. The whole bush is armed with very strong, long and sharp *thorns*, spreading in every direction. *Leaves* on long stalks, each of three equal, broadish-obovate, sometimes emarginate, leaflets; rather hairy beneath. *Flowers* half the size of *S. scoparium*, solitary or aggregate, stalked. *Calyx* membranous, with obsolete teeth. *Legume* pendulous, compressed, thick-edged, slightly tumid, smooth, an inch and a half long, with from two to four *seeds*.

25. *S. villosum*. Hairy-podded Thorny Broom. Vahl Symb. v. 2. 80. Willd. n. 24. Sm. Fl. Græc. Sibth. t. 673, unpublished. (*S. lanigerum*; Desfont. Atlant. v. 2. 135. *Cytisus spinosus creticus*, siliquâ villis densissimis longissimis et incanis obductâ; Tourn. Cor. 44.)—Leaves ternate, stalked, obovate. Flowers axillary. *Calyx* hairy. Branches furrowed, spinous, downy. *Legume* linear-oblong, very hairy.—Native of Gibraltar, Barbary, and Crete. Dr. Sibthorp found it every where in Greece and the isles of the Archipelago, where it is known by the names of *ασπάλαρος*, or *ασπάλαθεις*, and he judged it to be the *ασπάλαθος* of Dioscorides. This species flowers in its native country in April. We have never met with a garden specimen. The habit of the whole plant is like the last, but the *spines* are all terminations of *branches*, which are finely downy, and neatly striated. In the *flowers* we scarcely observe a difference, except the dense hairiness of the *calyx*; but the *germen* is excessively hairy, and the *legume* differs essentially in its narrower, more linear, form, and its dense clothing, of long shaggy hairs.

26. *S. horridum*. Many-thorned Broom. Vahl Symb. v. 1. 51. Willd. n. 25. Sm. Fl. Græc. Sibth. t. 674, unpublished.—Leaves ternate, linear, folded, silky. Branches opposite, aggregate, furrowed, spinous. Flowers lateral. *Legume* ovate, hairy as well as the *calyx*.—Native of Spain, as well as of hills in Greece and the Archipelago. This is a very densely branched *shrub*, like a furze bush, beset with innumerable, thorny, clustered, somewhat hairy, *branches*, bearing a very few and small *leaves*. The *flowers* are yellow, but half the size of the last, placed two or three on each young branch, near its point. *Calyx* pale, two-lipped, hairy, as well as the *keel*, and little, tawny, ovate or rhomboid, pointed *legume*, which scarcely contains more than one seed.

The *S. complicatum*, Linn. Sp. Pl. 996, is now *Cytisus divaricatus*, Willd. Sp. Pl. v. 3. 1119. Ait. Hort. Kew. v. 4. 319. Curt. Mag. t. 1387. Sm. Fl. Græc. Sibth. t. 704, unpublished.—*Cytisus* differs from *Spartium* in having the *filaments* separated to the very bottom, into two distinct sets, and the *germen* stalked. There is a general resemblance in habit between some of the species to each other. More

difficulty exists in distinguishing *Spartium* and *Genista*; the latter being characterized chiefly by the depression of its organs of impregnation along with the *keel*, while the *standard* is strongly divaricated. The involute *stigma*, and the *stamens* not being attached to the *germen*, are less obvious distinctions. See GENISTA.

Three Linnæan species of *Spartium*, as we have already hinted, named *contaminatum*, *sepium*, and *cytisoides*, with one from the first edition of Aiton, *sericeum*, all natives of the Cape of Good Hope, are removed by Thunberg from hence, and established, with four other shrubs from the same country, as a distinct genus, named LEBECKIA, in Thunberg's *Prodromus*, and in Willd. Sp. Pl. v. 3. 946. Ait. Hort. Kew. v. 4. 261. This ranges next after *Genista*, and is defined as follows.

Ess. Ch. *Calyx* in five deep acute segments, with rounded sinuses. Filaments monadelphous. *Legume* cylindrical, with many seeds.

Section 1. *Leaves simple*.

1. *L. contaminata*. Narrow-leaved Lebeckia. Willd. n. 1. Ait. n. 1. (*Spartium contaminatum*; Linn. Mant. 268.)—Leaves simple, linear-thread shaped, smooth, stained at the base. Flowers racemose.—Native of sandy ground at the Cape. *Stem* shrubby, branched, smooth and round. *Leaves* alternate, an inch and a half or two inches long, acute, glaucous; flattish above; purple at the base. *Flowers* in a long, simple, terminal *cluster*, orange-coloured, with a yellow *keel*. The *stamens* are described as all equally combined. We know not by what accident Thunberg calls the *flowers* umbellate, which Willdenow copies, in direct contradiction to the Linnæan description subjoined.

2. *L. sepium*. Capillary Lebeckia. Willd. n. 2. (*Spartium sepium*; Linn. Sp. Pl. 995. *Lathyroides*, vel *lathyris* congener, *linariæ foliis*, *æthiopicum*; Pluk. Mant. 114. *Amalth.* t. 424. f. 1. Yellow Cape Broom, with fennel leaves; Petiv. Gazoph. t. 83. f. 3.)—Leaves simple, capillary, smooth. Flowers racemose.—Native of the Cape, like all the rest of the species. This has more copious, longer, and much slenderer *leaves* than the foregoing, with larger *flowers*, whose tenth *stamen* is separated, in its upper part at least, from the rest.

3. *L. pungens*. Spinous Downy Lebeckia. Thunb. Prodr. 122. Willd. n. 3.—“Leaves simple, obovate. Branches downy, all becoming spinous at the end. Flowers solitary.”

Section 2. *Leaves ternate*.

4. *L. armata*. Thorny Grey Lebeckia. Thunb. Prodr. 122. Willd. n. 4.—“Leaves ternate. Branches hoary, round, becoming thorny. Flowers racemose.”

5. *L. densa*. Dense-leaved Lebeckia. Thunb. Prodr. 122. Willd. n. 5.—“Leaves ternate, villous; leaflets convolute, oblong. Flowers racemose, distant.”

6. *L. humilis*. Dwarf Lebeckia. Thunb. Prodr. 122. Willd. n. 6.—“Leaves ternate, villous; leaflets linear-oblong. Flowers racemose, reflexed. Branches incurved.”

7. *L. sericea*. Silky Lebeckia. Thunb. Prodr. 122. Willd. n. 7. Ait. n. 2. (*Spartium sericeum*; Ait. ed. 1. v. 3. 12.)—“Leaves ternate, silky; leaflets linear. Flowers racemose. Branches angular.”—Sent by Mr. Masson to Kew, in 1774. It flowers in the greenhouse, in April.

8. *L. cytisoides*. Cytisus-leaved Lebeckia. Willd. n. 8. Ait. n. 3. (*Spartium cytisoides*; Linn. Suppl. 320. *Ebenus capensis*; Linn. Mant. 264. *Trifolium africanum* fruticosum, folio angustiore, flore rubicante; Commel. Hort. v. 2. 213. t. 107.)—Leaves ternate, silky; leaflets linear-lanceolate. Flowers racemose. Branches round.—Communicated by Thunberg to Linnæus. Masson sent it from the Cape to

New garden in 1774, where it flowers in the greenhouse, in April. We presume this to be nearly akin to the last. The leaves in the original specimen are silky, not villous; each leaflet above an inch long. Flowers large, in terminal solitary clusters. Calyx bell-shaped, smooth, coloured. Petals reddish. Legume long, with the rudiments of many seeds, only one of which is said to come to perfection.

SPARTIUM, in Gardening, contains plants of the deciduous and evergreen kinds, among which the species cultivated are the common broom (*S. scoparium*); the Spanish broom (*S. junceum*); the starry broom (*S. radiatum*); the white-flowered single-seeded broom (*S. monospermum*); the yellow-flowered single-seeded broom (*S. sphaerocarpum*); the scorpion broom (*S. scorpius*); the angular-branched broom (*S. angulatum*); and the prickly broom (*S. spinosum*).

In the first species there are several varieties, some of which merit a place among flowering shrubs; as that with a purple calyx, and the flowers strongly tinged with orange, as well as that which is very hoary.

The second species has also a variety with double flowers.

Method of Culture.—The three first sorts are hardy, but the others more tender, especially in their young growth. And they are all capable of being raised from seeds, and the double-blossomed sorts also by layers and cuttings. The seeds should be sown in the early spring, as about April; the hardy sorts in beds of common earth, either in drills, or by bedding in to the depth of an inch: but in the tender sorts, in pots or beds hooped over to protect them in frosty weather. In the following spring they should be removed into nursery-rows or larger pots, according to the kinds, shortening their tap-roots, and setting them out in rows two feet apart, at the distance of one in the rows, to remain two or three years, when they may be planted out in the shrubbery, or other places where they may be wanted: the tender sorts in pots, being removed to the greenhouse or garden for protection in winter, and managed as the hardy sorts of plants of this kind.

But the layers should be laid down in the autumn or spring, and the cuttings may be planted out in the spring or summer, some in the open ground, and others in pots plunged in the hot-bed, to promote their striking root. They may be managed afterwards as the other sorts. This is the only certain mode of preserving the varieties.

All the hardy sorts are very ornamental in the borders, clumps, and other parts, and the tender kinds in greenhouse collections, and among other more hardy potted plants.

It is constantly proper, as a precautionary practice, to have some of the tender sorts of these plants always in pots, under the greenhouse management, with the view of more certainly preserving them, in case those which are planted out in the shrubberies or other parts of the open grounds should suffer much or be wholly destroyed by the too great severity of very severe winter seasons. And as the long roots of the plants which are naked or but thinly set with fibres, are not unfrequently disposed to run downwards with a long tap-root, they should be planted out when young as much as possible where they are to remain and grow, as they do not succeed well, where they are transplanted or removed into a new situation when of a large or old growth.

SPARTIUM *Scoparium*, *Common Broom*, in the *Materia Medica*. The tops and seeds are directed for use: the tops and leaves have a nauseous bitter taste, imparted by infusion both to water and spirit. They are commended for their purgative and diuretic qualities, and have therefore been successfully employed in hydropic cases. Dr. Cullen ordered half an ounce of fresh broom-tops to be boiled in a pound

of water till one half of this is consumed, and gave of this decoction two table-spoonfuls every hour, till it operated by stool, or till the whole was taken. It seldom failed, he says, to operate both by stool and urine; and by repeating this exhibition every day, or every second day, some dropsies have been cured. It is affirmed, that a patient, by taking half a pint of a decoction of green broom-tops, with a spoonful of whole mustard-seed, every morning and evening, was cured, after being tapped three times, and trying the usual remedies given in dropsies. The ashes of broom have also been much used in dropsies, and principally on the authority of Sydenham, whose account of their good effects has been confirmed by the testimony of Dr. Monro, who gave a drachm divided into three doses every day, and by other writers; the efficacy of this medicine depending entirely upon the alkaline salt, and not at all upon the vegetable from which it is obtained. The seeds and flowers of broom are said to be emetic and cathartic; but the evidence upon which this assertion rests is not wholly to be relied upon, as the former, when roasted, have been used as a substitute for coffee, and the latter employed as a pickle. Ray informs us, from the MS. of Dr. Hulse, that the flor. genist. given in the form of electuary, with honey of roses, were found very efficacious in scrophulous affections. Woodv. Med. Bot.

SPARTOPOLIAS LAPIS, in *Natural History*, a name given by some authors to a whitish agate, variegated with long and slender streaks of grey, disposed in a variously undulated order, and resembling grey hairs.

SPARUS, in *Ichthyology*, a genus of fishes of the order Thoracici, of which the generic character is; teeth generally strong; the grinders somewhat obtuse and crowded; the lips are doubled; gill-membrane five-rayed; the cover fealy; the body compressed; the lateral line curved on the hind part; the pectoral fins are rounded.

The name *sparus* is of Greek origin, being derived from the verb *σπαρίζω*, to palpitate or tremble; and was given to this fish from its remarkable quality of trembling or palpitating all over the body, as soon as taken out of the water.

There are, according to Gmelin, about forty species, separated into divisions, and classed according to their colours; but Dr. Shaw has enumerated nearly four times that number. The greater number of species being exotic, little is known of their history; they are evidently allied to the Labri. See LABRUS.

Species.

§ A. *Marked with a black Spot.*

*AURATUS; or Lunate Gilt-head. The specific character of this is, that between the eyes there is a semilunar spot. The general length of this fish is about fifteen inches; but occasionally it is found of a far larger size: the body is broad and thin; the back rising into a carina. Dr. Shaw gives the specific character as silvery-blueish, with gold-coloured brows, and a purple spot beyond each side the head; but sometimes, he says, with the addition of several brownish longitudinal stripes. It is a native of the Mediterranean, Atlantic, and Indian seas, and held in considerable estimation as food. It was much admired by the ancient Greeks and Romans; by the former it was consecrated to Venus. It feeds on shell-fish, which it grinds with its strong teeth before it swallows. It is sometimes found of the weight of eight or even ten pounds.

ANNULARIS. Yellowish, with a black ocellate spot near

SPARUS.

the tail. This is found chiefly in the Adriatic. The colour of this species resembles that of the common perch: at a certain distance from the base of the tail a round black spot is situated at the bottom of the last dusky bar of the body; the pectoral fins and tail are red, the rest blackish. Native of the Mediterranean, and not at all in esteem for the table.

SARGUS. The body of this is marked with black bands, and a black ocellate spot near the tail. It inhabits the southern coasts of Europe. The body is oval, broad; the teeth are equal, obtuse; and the tail forked. It is nearly of the size of the auratus, and the shape very like that, but deeper in proportion. It is much esteemed as food.

MELANURUS. Body with longitudinal lines and a black ocellate spot near the tail. This species is found in the southern European seas. It is described by Shaw as silvery, with a blue back; the sides have a stripe, spotted longitudinally with brown, and a black spot at the base of the tail.

SMARIS. A black ocellate spot on each side; pectoral fins and tail red. It inhabits the Mediterranean.

MENA. Body variegated; a blackish spot on each side. This is also found in the Mediterranean.

SAXATILIS. Body whitish; a black ocellate spot at the base of the tail. This is found on the coasts of Surinam. The snout is depressed; and the tail rounded.

ORPHUS. A black ocellate spot at the tail; the head is reddish; the tail is entire.

PUNCTATA. Mouth cupidate; the tail entire; in colour it is partly black. It inhabits the shores of Sardinia. In size and colour it is nearly allied to the *S. fargus*.

ARGENTATUS. This has a black spot behind the gills. It is found on the coasts of Japan; is six inches long; the body is covered with silvery scales; before the eyes are two nostrils.

NOTATUS. Dorsal fin divided; the gill-covers and tail spotted with black. It is found at Japan. The head is coated with silvery scales, nearly as long as the fingers.

§ B. *Body mostly red.*

ERYTHRINUS. The tail of this fish is nearly entire; the body red. It inhabits the European, American, and Japan seas. It is often eaten, but is not held in any great estimation; and it has sometimes proved poisonous: the iris is silvery.

INSIDIATOR. Body red, yellowish at the sides; tail a little forked. It inhabits the Indian ocean; is about ten inches long; catches aquatic insects, like the *Chætodon rostratus*, with its snout, which it can lengthen out into a tube; the body is rather broad, fat, coated with large scales of a metallic-green colour at the edge; when dead it becomes brown; the flesh is eatable. It is described as having a compressed head, and scaly; the eyes are lateral; jaws divided, each with two large straight conic teeth in the middle; gill-covers very entire; first lateral line nearer the back, beginning at the end of the dorsal fin, the other straight; the vent is nearly in the middle; the fins are yellowish; the dorsal and anal fins are marked with green bands; the last ray but one of the anal is very long.

* **FORMOSUS.** Red; longitudinal marks on the body and tip of the tail blue. This fish is figured in Dr. Shaw's *Naturalist's Miscellany*, and he suspected that it was a British fish; hence it is marked with an asterisk. The fore-part of the dorsal, and edge of the anal fins, are blue.

* **PAGRUS;** the Red Gilt-head. This is reddish; the

skin, at the end of the dorsal and anal fins, gathered up, and hiding the last rays. It is found in the European seas. In shape, teeth, and size, it resembles *S. auratus*. The iris is silvery; infides of the gill-covers, mouth, and tongue, are of a fine red; at the base of the pectoral fins is a ferruginous spot; the scales are large; and the tail is forked.

SPINIFER. Dorsal spines recumbent; the five middle ones filiform and longer. This inhabits the muddy deeps of the Red sea; is about a span and a half long. The body is silvery, but with a reddish hue; the back is marked with darker lines; the scales are broad, very entire, obscurely streaked, and the flesh is reckoned excellent.

PALPEBRATUS. This is of a chestnut-red; the eyes are of a pale yellow, covered with a loose yellowish membrane. This is found on the coasts of Amboina. It resembles a perch; but the head is more obtuse.

§ C. *Body marked with Lines.*

BOOPS. Longitudinal lines dusky; the four lower ones are gold and silvery. It inhabits the sea round Japan.

CANTHARUS. The tail is without spots; the body is marked with longitudinal lines. It inhabits the coast of Tuscany. The iris is silvery.

CHROMIS. The tail is bifid; the second ray of the ventral fin is setaceous. It inhabits southern Europe.

SALPA. Tail bifid; the body is marked with eleven tawny longitudinal lines. It is found in the Mediterranean.

SARBA. This is of an oblong oval shape, silvery, with numerous obsolete stripes; the ventral fins are yellow, with a golden line on each side near them. It inhabits the Mediterranean, and along the coasts of Arabia. The body is broad, and covered with broad entire scales; there are seventeen longitudinal brownish stripes on each side; the flesh is reckoned pleasant.

SYNAGRIS. The tail is bifid, red; the body is purplish, with seven gold lines on each side. It inhabits South America.

RHOMBOIDES. The tail is entire; the back is caniculate; the body with yellow lines. It inhabits America, and is there called the salt-water bream. The teeth are obtuse; between the roots of the pectoral and dorsal fins a black spot; the ventral, anal, and caudal fins are tawny.

LATUS. Yellowish; the head is silvery; the scales longitudinally imbricate. It inhabits about the coasts of Japan; is three inches long, and one and a half broad.

VIRGATUS. The tail is forked; the body is depressed, oblong, striped with scales. This is found on the coast of Japan.

HAFFARA. Silvery, with fourteen obsolete yellowish-brown lines on each side; the tail is bifid. It inhabits the muddy shores of Arabia; is about a span long; and the flesh is reckoned good.

BERDA. Whitish-ash; lateral scales with each a transverse brown band in the middle; the dorsal spines are recumbent. It is found in the Red sea. The body is oval; the back is gibbous, with obsolete bands; beneath it is white; the scales are broad, round, and entire.

CHILENSIS. The tail is bifid; the body is marked with transverse brown lines on each side. It inhabits, as its specific name denotes, Chili, in South America. It grows to full six feet long; in shape it is oval, depressed, coated with large rhomboidal margaritaceous scales, spotted with white; the flesh is good.

§ D. *Various.*

CHRYSOPS. The tail is semi-lunar; the back is grooved; the

the iris is golden. It inhabits Carolina. The body is blueish.

ARGYROPS. Tail semi-lunar; the back is grooved; iris is silvery. It inhabits Jamaica and Carolina. It resembles the last. The three first rays of the dorsal fin end in a long bristle.

DENTEX. The tail is bifid; the body is variegated; four of the teeth are larger. It inhabits many parts of Europe, and the Cape of Good Hope.

SPINUS. Tail bifid; dorsal spine recumbent. It inhabits South America and India. The body is apparently painted with blue recurved blotches.

RADIATUS; Pudding-fish. The tail is entire; lateral line composed of linear scales, divided into three bifid branches. This is found on the coast of Carolina. Above it is a green purple at the sides; beneath rufous; head varied with blue, yellow, and green streaks.

VIRGINICUS. The tail is bifid; the body with two black transverse bands, and numerous longitudinal lines. It inhabits North America.

MORMYRUS. The tail of this species is bifid; body with numerous silvery and black bands. It inhabits Tuscany.

CAPISTRATUS. The tail of this is entire; the body is reticulate with white. It inhabits America. Body oblong; scales loosely imbricate, with a white band bent into a right angle before the edge.

GALILÆUS. The tail entire; body above is greenish, beneath white. It inhabits the lake Genesareth, in Galilee.

FUSCESCENS. Brownish; scales golden; near the pectoral fins a black spot. It inhabits Japan, and is about four inches long.

* **NIGER;** Toothed Gilt-head. The back is black; the sides brighter; belly silvery. This is found on the coasts of Yorkshire. It is described in Pennant's British Zoology. The body is twenty-six inches long, and ten broad; eyes large; teeth in the lower jaw slender, sharp, and on each side a slender canine tooth, in the upper jaw a single row; the first seven rays of the dorsal fin high, the rest low; this fin and the anal covered with imbricate scales.

SPARUS, among the Romans, a kind of rustic weapon, bent backwards like the foot. It was likewise used for a small dart, or missile weapon.

SPASA, in *Geography*, a town of Russia, in the government of Archangel; 40 miles S.W. of Mezen.

SPASK, a town of Russia, in the government of Kazan, on the Volga; 40 miles S. of Kazan. N. lat. 55°. E. long. 49° 14'.—Also, a town of Russia, in the government of Tambov; 92 miles N.N.E. of Tambov. N. lat. 54° 2'. E. long. 42° 58'.—Also, a town of Russia, in the government of Riazan, on the Oka; 32 miles E.S.E. of Riazan. N. lat. 54° 32'. E. long. 39° 50'.

SPASKAIA, a town of Russia, in the country of the Cossacks, on the Don; 52 miles S.S.W. of Arkadinskaia.—Also, a town of Russia, in the government of Upha; 8 miles S. of Verchouralsk.

SPASKOI, a town of Russia, in the government of Kolivan. N. lat. 55° 38'. E. long. 86° 14'.—Also, a town of Russia, in the government of Tobolsk; 36 miles N. of Tomsk.—Also, a town of Russia, in the government of Tobolsk; 20 miles W. of Narim.—Also, a town of Russia, in the government of Olonetz; 60 miles N.E. of Pudoga.

S^PASM, in *Medicine*, *σπασμοί*; from *σπασω*, *I draw*, or *contract*, a *cramp*, in its modern sense, signifies a continued and painful contraction of a muscle, or any portion of muscular fibres; in which signification it stands in opposition to

convulsion. This, however, appears to have been an arbitrary determination of its acceptation, which does not strictly accord with the original use of the word. For Celsus has distinctly defined *spasm*, as meaning convulsive motion, and applies the word *tetanus* to the rigid and fixed contraction, as we have stated in another place. “*Modo nervorum dilationem, modo rigorem; illud σπασμὸς, hoc τετανωσ, Græcè nominatur.*” (De Medicinâ, lib. ii. cap. 1.) See **CONVULSIONS**. Some writers, however, have applied the term, *spasm*, to both these forms of disease; using the epithet of *tonic* to signify the state of rigid contraction, and *clonic* to denote the violent contractions and relaxations of convulsion. Others again have applied the word to every irregular action of the muscular or moving fibres, in any part of the body. (See Cullen, First Lines, par. 1251.) This latitude has led the celebrated author, just quoted, to bring together diseases, which have very little resemblance in the morbid actions which constitute them; as, for instance, hysteria, diabetes, colic, and hydrophobia, which are classed together as *spasmodic* affections of the natural functions, in his system of nosology.

The various functions of the animal body are performed by certain contractions of the moving or muscular fibres, in which alone that power is inherent. These contractions are excited either by the will, in those muscles which obey the faculty of volition; or by certain stimuli or causes of irritation, appointed by nature for that purpose, in those which are not under the influence of the will. The blood, for instance, excites the motions of the heart; the passing aliments produce the peristaltic contractions of the bowels; and so forth. In a state of health, the contractions are regulated in force and velocity by the will, or by these natural irritations; and whether produced by the one or the other, they are always soon succeeded by a state of relaxation, and are not repeated, until the will or these natural excitements operate again. But in a morbid state, the contractions of the moving fibres, ordinarily depending on the will, are excited without the concurrence of the will, or contrary to what it intends; and in the other functions, they are excited by the action of unusual and unnatural causes, or, from too great mobility, are roused to more violent and continued contractions by the ordinary causes. When the contractions are more violent in degree than is usual in health, and are neither succeeded by a spontaneous relaxation, nor even yield readily to an extension, either from the action of antagonist muscles, or from other extending powers applied, this state is called a *tonic spasm*, or simply a *spasm*. For an account of the successive violent contractions and relaxations under this morbid excitement, see **CONVULSIONS**.

The presence of spasm, in any muscular part, is indicated by intense *pain*, (and it must be obvious, from what has just been stated, that those pathologists, who speak of spasmodic affections of nerves, membranes, and such uncontractible parts, use an erroneous language;) a symptom, however, which occurs also in inflammation of the same parts: and as the remedies for inflammation are injurious in spasm, and *vice versa*, it is always important to ascertain the real origin of such pain. The pain arising from spasm commonly attacks very suddenly, or even instantaneously; it generally comes and goes, or is intense for a while, and then subsides at intervals, as the spasm *recurs* and relaxes; it very often shifts its seat, as different portions of the muscular fibres of any part are successively contracted; and, above all, it is not attended with general fever, and the pulse is neither accelerated, nor increased in hardness. The pain connected with inflammation of any organ is commonly more slow and gradual in its attack; it is accompanied or preceded by shivering;

shivering; it is fixed both in respect to the intensity and to the seat of it; and it is attended by symptoms of fever, heat of skin, a quick and hard pulse, thirst, &c. The kind of pain, too, is described as different: that of spasm being accompanied by a sense of constriction; while that of inflammation is combined with a sense of stabbing or cutting, and often of throbbing, burning, &c.

Of these painful spasmodic diseases, the *tetanus* is the most formidable and fatal, in which all the voluntary muscles are rigidly contracted, and the body and limbs stiffly extended; in short, an universal cramp exists, and the pain of such a condition may be conceived, if we consider the suffering produced by a partial cramp. Sometimes the antagonist muscles of the back are most affected, when the body is rigidly bent backwards, like a bow, and rests upon the back of the head and the heels, when it is called *opisthotonos*; and sometimes the anterior muscles are most contracted, and the bend is forwards, which is called *emprosthotonos*. (See TETANUS.) The jaw is firmly locked in this complaint; and when the spasm is confined to that part, it is called TRISMUS, or locked-jaw; which see. Less formidable, though very painful, spasms occur in the muscular coat of the intestines, constituting *colic*; or in that of the stomach, which is usually called *cramp in the stomach*. In hysterical women, various cramps of these parts, and of the voluntary muscles, are liable to occur. The fit of spasmodic *asthma* is principally produced by a spasmodic contraction of the muscular fibres about the larynx, and of the muscles subservient to respiration.

In the pathological doctrines of Dr. Cullen relative to the nature of fever, *spasm* holds a distinguished place, and is considered, indeed, as the essence of fever. This hypothetical spasm was supposed by him to take place in the extremities of the arteries, and especially of those on the surface of the body, and to be demonstrated by the paleness and shrinking of the external parts, and the suppression of the excretions, constituting the cold fit; and the hot fit, which ensues, was believed to be an effort of the constitution, a reaction of the powers of life, and of the heart and arteries in particular, to overcome and to relax this spasmodic constriction of the extreme vessels; and this reaction, or fever, therefore, is seen to continue until the relaxation of the spasm is effected. (See First Lines of Pract. of Physic, par. 40. et seq.) We have confuted this hypothesis at considerable length, in another place, (see FEVER, Dr. Cullen's Theory,) and shall not dwell upon it here. It is altogether gratuitous, and unsupported by facts; but it has had considerable influence in modern practice.

The causes of *spasm* may be reduced to two heads: *debility*, and its concomitant irritability, in the whole system, or in particular organs, which are, therefore, excited to inordinate actions by the ordinary stimuli; and *irritation*, that is, the actual operation of unusual and extraordinary stimuli. If these two causes are combined, it is obvious that any excitement, very little greater than ordinary, may produce violent spasm, or very inordinate actions: whence it happens, that in constitutions of particular irritability, very slight irritations will occasionally produce the most severe spasmodic disorders. Thus the most violent of all, the *tetanus*, is often occasioned by a scratch or slight wound of the skin; and the locked-jaw of new-born infants appears to originate in the irritation of the meconium retained in the bowels. If the irritation of worms, and even morbid secretions, in the intestines are sufficient, in children, to produce actual convulsions, it need not be matter of surprise that colic and cramp of the stomach should be occasioned, in irritable adults, by undigested food, and hot stimulating

drinks. Very slight irritations, both external and internal, excite spasms in such habits; even the puncture of a needle (Mem. of the Med. Society of Lond. vol. ii.); and the pressure of a tumour on a nerve, irritation from distended vessels, or bony excrescences in the cranium, have all given rise to spasm.

The chief remedies for spasm are those which lessen irritability, or which excite increased power of action, or produce a sudden and considerable commotion, and those which remove the irritating cause. The first mentioned are usually called *antispasmodic* medicines. The most effectual of these are anodyne or narcotic substances, especially opium, hyocyamus, and conium, which tend to lessen the sensibility of the whole frame, and, therefore, to render it less liable to be acted upon by irritants. The term *antispasmodic*, however, has been much applied to medicines of a stimulant quality, and especially to some strong-smelling substances, which alone are much less efficacious in relieving spasm than the narcotics. Of the latter class are musk, castor, camphor, and assafoetida; and of the more stimulant class are alcohol, æther, ammonia, the essential oils, &c. Perhaps the most efficacious remedy is composed by uniting the latter with the anodynes; for we know of no relief to violent spasmodic pain more effectual than that produced by a combination of laudanum with æther. Among the stimulants that are often remedial in cases of spasm, heat is not the least important. Fomentations, hot water, a hot brick, a bag of heated bran, &c. applied externally near the seat of spasm, will often afford speedy relief; and a large draught of hot water, taken as warm as the stomach will bear it, has produced a similar good effect.

It is probably chiefly from the stimulant effect of violent emotions that relief is obtained from them in spasmodic pain; but sudden terror, or surprise, or apprehension, have succeeded in removing it. The influence of mental emotions, indeed, both in producing and curing spasm, and even convulsions of the most violent nature, is equally curious and inexplicable. See IMITATION and CONVULSIONS.

Where spasm depends upon irritation, the cause must be investigated, and, if possible, removed by appropriate remedies, if within their reach. Thus clearing the bowels, where there is an obvious irritation from worms, undigested aliment, morbid bile, &c. will sometimes entirely remove the spasms. In order to prevent a recurrence, by invigorating the system, and thus lessening its irritability, after the spasms have been subdued, it is often necessary to resort to the use of tonic remedies. Of these a great variety has been employed, at different periods, with various reputation. Cold bathing, the use of the shower-bath, or tepid bathing, as at Buxton, may be considered as one of the most effectual tonics; after which may be mentioned some of the metallic tonics, such as the various preparations of iron, copper, zinc, and silver, all of which are often efficient remedies. The cinchona, columba, cascarilla, gentian, and other vegetable aromatic bitters, with or without an addition of the mineral acids, have also their value as tonics, and contribute to restore vigour and lessen irritability in debilitated habits.

SPASMODIC, something belonging to a spasm, or convulsion; as spasmodic medicine, spasmodic disease, &c.

Hunger, according to M. Hecquet, is a spasmodic affection of the fibres of the stomach; unless it arise from the fibres being too much moistened by the liquors thereof, so as to incapacitate them for their office. See HUNGER.

SPAT, a term used by the fishermen for the spawn of oysters, which is cast in the month of May.

SPATAGOIDES, in *Natural History*, the name of a genus of the echini marini, the characters of which are, that it has the aperture for the anus on one side of the upper surface, and has a large furrow on the back, which makes it of a cordated form; but has no furrows on the vertex, but only four or five smooth rays, made of a number of slight transverse litz.

SPATALLA, in *Botany*, a name of Mr. Salisbury's.—Brown Tr. of Linn. Soc. v. 10. 143. Ait. Hort. Kew. v. 1. 203.—Clas and order, *Tetrandria Monogynia*. Nat. Ord. *Proteaceæ*, Jull. Brown.

Ess. Ch. Corolla four-cleft. Stamens in the concave tips of the segments. Nectary four scales beneath the germen. Stigma oblique, dilated. Nut superior. Involucrum of from two to four leaves, containing one, or a very few, flowers. Common receptacle naked.

An occasional irregularity in the *corolla*, and the oblique *stigma*, are the only characters which distinguish this genus from *Sorocephalus*; for in habit they strictly accord. We cannot but, therefore, advise their union, under the latter name, whose derivation is the best.

The species of *Spatalla*, defined by Mr. Brown, are 15, one of which only finds a place in Mr. Aiton's work. They are disposed in two sections, of each of which we shall give an example or two.

Section 1. *Involucrum single-flowered. Stigma concave, spoon-shaped. Corolla unequal. Ten species.*

S. mollis. Soft *Spatalla*. Br. n. 1.—“Involucrum of two entire leaves. Leaves straight, villous, as well as the young branches.”—Native of hills at the Cape of Good Hope. Communicated by Mr. John Roxburgh, to Mr. Lambert. An upright *shrub*, with copious reddish branches; the young ones slender, erect. *Leaves* slightly spreading, seven or eight lines long, silky with moderately spreading hairs, and tipped with a very sharp callous point. *Spike* sessile, erect, solitary, dense, racemose, of an oblong cylindrical shape, hardly an inch in length. *Bractæas* leafy, twice as long as the partial flower-stalks. *Involucral leaves* ovate, villous, the outer one broadest. *Corolla* densely bearded, purplish; the marginal hairs of its larger segment inflexed. *Scales* under the germen linear permanent.

S. prolifera. Proliferous *Spatalla*. Br. n. 8. (Protea prolifera; Thunb. Diff. n. 27. t. 4. Linn. Suppl. 118. Willd. Sp. Pl. v. 1. 518.)—Involucrum of four leaves, withered at the points. *Spike* in a conical head. Flowers nearly sessile. Stem proliferous.—Native of hills at the Cape of Good Hope. An upright *shrub*, from a foot and a half to two feet high, much branched in a proliferous and umbellate manner; the young branches somewhat silky. *Leaves* closely imbricated, hardly three-quarters of an inch long, awl-shaped; silky on the younger branches. *Spikes* sessile, solitary, terminal, but surmounted by subsequent branches from their base. *Corolla* very densely silky; its outer segment twice as large as the others. *Stigma* flattish, with a central tubercle.

Section 2. *Involucrum with three or four flowers. Stigma rather convex. Corolla almost equal. Five species.*

S. incurva. Incurved-leaved *Spatalla*. Br. n. 11. Ait. n. 1. (Protea incurva; Thunb. Diff. n. 22. t. 3. Willd. Sp. Pl. v. 1. 516.)—*Spikes* racemose, somewhat stalked. Involucrum downy, longer than the bractæas, with about four flowers. Leaves incurved. *Corolla* unequal.—Native of moist, sandy, rather shady situations at the Cape of Good Hope. Mr. Masson sent it, in 1789, to Kew, where it flowers in May and June. The leaves are numerous, slender, above an inch long, spreading, ascending at the points.

Spikes generally aggregate, oblong, lax. *Bractæas* nearly the length of the partial stalks. Mr. Brown notices a variety, or perhaps distinct species, whose leaves are shorter and more crowded, *spikes* solitary, and *bractæas* longer than the partial stalks. *S. incurva* bears a close resemblance to some species of *CONOSPERMUM*. See that article.

The descriptions of the genera of *SOROCEPHALUS* (see that article), and *Spatalla*, suggest to us a doubt whether the species of these genera may not, in some instances at least, differ sexually only from each other. Not having seen many of them, we cannot examine critically into each species, but, in a general view, the male organs seem most perfect in *Sorocephalus*, the female in *Spatalla*. The regularity or irregularity of the *corolla* does not seem, in this case, to constitute a sufficient generic difference.

SPATANGI, in *Natural History*, the name of a genus of the echini marini, including all those which are marked in the shape of a heart, and have the aperture for the anus in one of the sides of the upper superficies. These have all a remarkable furrow on the back; their base is nearly flat, and they have several furrows on the vertex. By these characters they are distinguished from the briffi, with which they have in common the marks of two lips to their mouth, and want the teeth which the other kinds have.

SPATAREI, in *Geography*, a town of the island of Samos; 5 miles S.S.W. of Cora.

SPATARO, GIOVANNI, of Bologna, in *Biography*, the disciple of Ramis, a Spaniard, the first modern who sustained the necessity of a temperament; which gave birth to a controversy among musicians in Italy, that continued with great warmth during many years, and which has been revived in France during the latter end of the last century, with due polemic heat, by the writings of the abbé Rouffier. (See *PYTHAGORAS*.) Spataro published a work in defence of his master's opinion, in which he treated the venerable Franchinus, and even Guido himself, with great obloquy, for not having discovered the necessity of a temperament. See *RAMIS*.

SPATHA, is a word used by different authors in various senses: some express by it a rib; others the instrument called by surgeons a spatula, and is used for spreading ointments and plasters; and Celsus calls a sort of incision-knife by this name. It is also used for the external covering of the fruit of the palm-tree, and by others for a sword. This last is indeed its proper signification, and all the others are only metaphorical applications of it to different things, which bear some resemblance to a sword.

SPATHA, in *Botany* and *Vegetable Physiology*, a Sheath, is a sort of *CALYX*, according to Linnæus, (see that article,) more or less remote from the flower, of which, therefore, it does not, like the *perianthium*, properly make a part. If of one valve only, it bursts longitudinally, as in the Narcissus and Snow-drop; but it often consists of many membranous valves, leaves, or scales, as in *Sowerbea*, *Pancreatium*, &c. The natural order of *Palmeæ* exhibits various kinds of *Spathæ*, in great perfection, each enclosing a branched many-flowered *SPADIX*. (See that article.) Perhaps, nevertheless, this organ might more correctly be esteemed of the nature of a *Bractea*, or floral leaf, not constituting, in any case, a part of the fructification, nor affording any share of the generic characters. We cannot but confess, that the more closely the definitions of genera are restricted to the real organs of the flower and fruit, without recurring to the inflorescence, or any of its accompaniments, the more correct and philosophical the science of Botany has always appeared in our eyes. Linnæus, led by Artedi, swerves

from this correctness in the *Umbelliferae*; and for want of sufficient information respecting the flowers and fruit of all the *Palmæ*, he was obliged to advert to other parts, to found any thing like plausible genera. Such aberrations from his own laws should rather be reformed, by those who have the means, than serve as examples for laxity of principle in other instances. The greatest artists ever require the fewest tools, and most simple materials; and the human intellect never makes such attainments as when necessarily put to its utmost exertions. Natural history, when studied with all the accuracy and intensity of which it is capable, becomes as instructive and philosophical a school for the mind as any science whatever; nor does any one require more deep judgment, as well as precise observation.

SPATHALIUM, among the Romans, an ornament which the women wore about their hands, not unlike the coral ones of the moderns.

SPATHELIA, in *Botany*, altered from Dr. Patrick Browne's name for the same plant, *Spathe*, and alluding to the simple undivided stem, crowned with a tuft of luxuriant leaves, like the Palm tribe; *σπαθην* being a palm-tree, or palm-branch.—Linn. Gen. 148. Schreb. 198. Willd. Sp. Pl. v. 1. 1496. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 2. 171. Juss. 371. Lamarck Illustr. t. 209. Gært. t. 58. (*Spathe*; Browne Jam. 187.)—Class and order, *Pentandria Trigynia*. Nat. Ord. *Terebinthaceæ*, Juss.

Gen. Ch. *Cal.* Perianth inferior, of five oblong, coloured leaves. *Cor.* Petals five, oblong, equal. *Stam.* Filaments five, awl-shaped, ascending, furnished with a tooth at the base; anthers ovate. *Pist.* Germen ovate, shorter than the stamens; styles three, very short; stigmas three, roundish. *Peric.* Capsule oblong, triangular, with three wings, of three cells, not bursting; each cell furnished with a lateral channel, full of resin. *Seeds* solitary, oblong, prismatic, or nearly cylindrical, tapering at each end.

Eff. Ch. Calyx of five leaves. Petals five. Capsule with three winged angles, and three cells. Seeds solitary.

Obs. Gærtner remarks, that the capsule is sometimes compressed, with two opposite wings only, and two cells; but this seems to arise merely from a failure of impregnation of one of the stigmas.

1. *S. simplex*. Sumach-leaved *Spathelia*. Linn. Sp. Pl. 386. Willd. n. 1. Ait. n. 1. (*Aceri* aut *paliuro* affinis arbor, caudice non ramoso, foliis forbi sylvetris, floribus pentapetalis racemosis speciosis purpureis, fructu sicco tribus membranulis extantibus alato; Sloane Jam. v. 2. 28. t. 171.)—Plentiful by the sides of rivers, among the rocky hills of Jamaica, according to Sloane and Browne. The latter erroneously calls it the Maiden-plum tree. This very handsome plant is said to have been introduced into the stoves of England, in 1778, by Dr. William Wright. The root is of a spreading nature, not striking deep. *Stem* quite simple and erect, an inch thick, naked, round, rising like a palm-tree, Sloane says, to the height of 40 feet, and crowned at the summit with a large tuft of pinnate, crenate, spreading leaves, surmounted, in the flowering season, with a vast compound panicle, many feet in height, of handsome purple flowers. The capsules are about an inch long.

SPATHESTER, the name of a surgical instrument used to draw the prepuce over the glans.

SPATHINUS, in *Natural History*, a name given by the Greeks to the stag or deer, when in its second year.

In the first, it was called *nebrus*; in the third year, *dicrotus*; and after this *cerastes*, as long as it lived.

SPATHIUM, in *Botany*, so denominated by Loureiro,

from *σπαθιον*, a little sheath, alluding to the form of its calyx.—Loureir. Cochinch. 217.—Class and order, *Hexandria Trigynia*. Nat. Ord. *Inundatæ*, Linn. *Naiades*, Juss.

Gen. Ch. *Cal.* Sheath stalked, of one leaf, roundish, spreading, single-flowered. *Cor.* none. *Stam.* Filaments six, short, inserted into the receptacle; anthers roundish, of two cells. *Pist.* Germen (superior) roundish, with four horns; style none; stigmas four, oblong, reflexed. *Peric.* Berries four, ovate, pointed, single-seeded. *Seeds* roundish.

Eff. Ch. Sheath roundish, stalked, single-flowered. Corolla none. Berries four, with single seeds.

1. *S. chinense*. *Thong pin ngau* of the Chinese.—Native of marshy places, near Canton in China. The stem is erect, three feet high, herbaceous, with spreading, flaccid, furrowed branches. Leaves heart-shaped, lanceolate, five-ribbed, smooth, scattered, with clasping footstalks. Spikes linear, nearly terminal. Such is the description of Loureiro, who conceives the above plant to be somewhat akin to the Linnæan *Aponogeton*, and also to *Potamogeton*. We have no acquaintance with it.

SPATHODEA, a genus founded by Palisot de Beauvois, in his *Flore d'Oware & de Benin*, on some of the Linnæan *Bignoniæ*, and named from the sheath-like form of their calyx. It is adopted by Mr. Brown, in his *Prodr.* Nov. Holl. v. 1. 471, under the following character.

Calyx sheath-like, cloven down one side, either toothed or entire at the end. Corolla somewhat funnel-shaped, with a five-lobed, rather unequal, limb. Stamens two long and two short, with a fifth abortive filament. Capsule pod-like, falcate, imperfectly four-celled. Partition transverse, corky.

The genus is shrubby or arboreous; with opposite, rarely alternate, pinnate leaves, sometimes simple. Flowers mostly panicle.

Bignonia spathacea, see *BIGNONIA*, n. 18, is an example of *Spathodea*, as is also *S. heterophylla*, and perhaps *alternifolia*, of Brown.

SPATHOMELE, a word used by some to express the spatula, used by the apothecaries and surgeons in mixing and spreading ointments and plasters.

SPATHOSE, in *Mineralogy*, having a crystalline structure.

SPATHULARIA, in *Botany*, from the spatulate shape of its head, a genus of *Fungi*, consisting of only one species.—Persoon Syn. Fung. 610.—Class and order, *Cryptogamia Fungi*. Nat. Ord. *Fungi*. Sect. *Gymnocarpi, helvelloidei*.

Eff. Ch. Club-shaped. Head compressed, membranous, decurrent at each side.

1. *S. flavida*. Yellow *Spathularia*. Perf. Disp. Meth. 36. Comment. 34—36. (*Clavaria Spathula*; Dickf. Crypt. fasc. 1. 21. Fl. Dan. t. 658. *C. spatulata* glabra; Schmid. Ic. t. 50. *Elvela secunda*; Schæff. Fung. t. 149. *Helvella spatulata*; Sowerb. Fung. t. 35.)—Found in fir woods, in autumn. Mr. Crowe first discovered it at Cosey, near Norwich, where, in the plantations of fir George Jerningham, it is very abundant, growing erect, in tufts. The stalk is about a finger's length, half an inch in diameter, hollow, rather uneven, whitish. Head vertical, obtuse, hollow, somewhat obovate, or inversely heart-shaped, pale buff, or yellowish, discharging innumerable minute seeds, in the form of smoke, from marginal pores. See *CLAVARIA*, n. 17.

SPATIUM, Lat., space, is applied to the void between the lines of the staff, upon which music is written. Spaces at first were not used, but there was a line for every sound

found (see NOTATION); but when the lines were reduced to four, as in the canto fermo of the Romish ritual, and afterwards increased to five, as in the present secular music, the spaces came into use; and the lowest was called the first, and so on to the fourth, fifth, and sixth, which unites the base with the treble. See RIGA, LINES, and STAFF.

SPATLING-POPPY, a name given to the common field-lychnis, a species of cucubalus, from the white froth found on it in the spring. See FROTH-Spit.

SPATOLA, in *Geography*, a town of Naples, in Calabria Ultra; 14 miles S. of Squillace.

SPATTERDASHES, a kind of covering for the legs, made of leather, &c. Those of soldiers are made of coarse linen, waxed over and buttoned tight.

SPATTS, a small sort of spatterdashes, reaching only a little above the ankle.

SPATULA, or SPATHULA, formed from *spatha*, of the Greek, *σπαθίον*, which signifies the fame; an instrument used by surgeons and apothecaries; made flat at one end, and round at the other; serving to spread their plasters and unguents.

The surgeons have little steel spatulas. And the apothecaries have also large ones of wood, to stir their drugs in diluting, tempering, or boiling them.

The spatula is used by surgeons to depress the tongue, in order to examine the state of the tonsils, uvula, and fauces, when they are affected with any disorders. It is also used to suspend the tongue, when the frænum is to be divided; for which purpose it has a suture at its extremity, and should rather be made of silver than of any other metal. These spatulæ are made of different shapes.

SPAVIN, formed from the French *esparvin*, which signifies the fame; a disease in a horse: being a swelling or stiffness, usually in the ham, which causes him to halt.

There are two kinds of spavins, *viz.* the *ox*, which is a callous tumour, at the bottom of the ham, on the inside, hard as a bone, and very painful. While it is yet young, some horses only halt with it at the first coming out of the stable. The *dry* spavin is more easily perceived, by the horse's raising one of his hind-legs, with a twitch, higher than the other: but sometimes it is found in both legs.

This kind, which some also call *string-halt*, frequently degenerates into the *ox* spavin; for which there is no remedy, but to apply the fire; and even this is not always successful.

There are two other kinds of spavin, which have their seat in the hoof, *viz.* the *blood* spavin, which is a soft tumour, that grows through a horse's hoof, and is usually full of blood; and the *bone* spavin, or crusty substance growing on the inside of the hoof, under the joint.

SPAWDER, in *Rural Economy*, a term provincially signifying an injury, by the legs of animals being forced too far asunder on ice, or slippery roads, &c.

SPAWN, in *Gardening*, the progeny or offspring of plants or other vegetables; but which is mostly applied to such small offsets, suckers, and sprouts, as rise numerously from the roots, &c. of certain plants, serving for the purpose of increase, which, as being parts similar to the whole plant, when separated from the parent vegetable and planted out, readily grow, and commence proper plants, and thereby renew or increase their respective kinds with great facility and abundance. Some plants produce them in large quantities, others scarcely at all. (See SUCKERS.) And in a more general acceptation, it is likewise peculiarly applied to the progeny of mushrooms, being an offspring from the root of those *fungi*, consisting of minute white parts, shooting and running in the earth or dung, like

small white thready fibres, assuming the appearance of slender white strings, which are productive of numerous minute white knobs, appearing at first of the size of small pin-heads, the whole smelling strong of the mushroom; and those little knobs being infant plants, they gradually increase in size to proper mushrooms, which are quick of growth, and of very short duration; but the same spawn running in the earth, &c. furnishes a plentiful supply of mushrooms from the bottom in regular succession for a considerable time, sometimes several months. See AGARICUS.

This sort of mushroom spawn may be procured at all seasons of the year, but more plentifully towards the end of summer and in autumn, from the places of its growth and production; such as old mushroom-beds, old horse-dung hot-beds, and horse-dunghills that are moderately dry, and which have remained undisturbed several months; also sometimes in old compost heaps, consisting chiefly of horse-dung; in all of which the spawnly substance discovers itself in dry lumps of dung and earth, which lumps should be taken up entire: likewise in stable-yards, where any quantity of horse-dung has lain dry and undisturbed any considerable length of time, lumps of spawn are often obtained. It is also found in great perfection in the horse-rides belonging to great inns, livery-stables, and horse-dealers, especially on the sides next the walls; likewise in horse-mill tracts, where horses are constantly employed in working and dropping their dung, which is swept together on the sides, there to remain; also in kitchen-gardens, where any piece of ground has been dunged in the spring with new, or but moderately rotted stable-dung, or old dry hot-bed dung, &c. and only slightly turned in, as already shewn under the head of making these beds. And sometimes it is produced naturally all over the surface of an old cucumber or melon hot-bed, both in the dung and earth, in autumn or winter, where the frame and lights have been continued over the bed; and where the earth of the bed is of a loamy nature, the spawn in which is often remarkably fine and strong; for in this kind of earth, of a moderately light quality, it is generally of a superior quality, and very productive; so as sometimes, in such old beds, where the frames and glasses remain, and the surface of the bed is covered thickly with dry straw, litter, or hay, under the glasses, to produce a full crop of good mushrooms towards the spring. Mushroom spawn is also obtained in meadows and pastures towards the end of summer and in autumn, before the rain and cold commences, as in the months of August and September, when the mushrooms rise naturally, serving as a direction to the place where to find it; but that found in the other places is mostly the best in quality. Some caution is also necessary in collecting spawn from fields to have it of the right sort.

On this subject it is necessary to observe, that there is also a fruitful and barren sort of mushroom spawn; the former is distinguished by the substance of the fibres or stringy white shoots, &c. and mushroom-like smell, as before observed; but in the latter sort, the thready fibres are far more abundant, fine, and downy, often appearing like a fine white down, and, being of no substance, produce only a flash of small white fungi, destitute of the fleshy part, and which, by the mushroom-men, is commonly called *white-cup*.

Methods are sometimes practised to obtain mushroom spawn more abundantly by art, by the effects of horse-dung, both in hot-beds and compost heaps; sometimes, in the former case, by planting small pieces of spawn, or spawnly earth, along the top edge of the later cucumber

hot-beds in summer, or in the sides of any horse-dung heaps, having a little warmth remaining; so that the moderate heat of the dung in the bed or heap may set the spawn a-running, so as sometimes to produce a few mushrooms in autumn, and increase it considerably for future use in spawning proper mushroom-beds: and in the second case, by a compost of dung and loamy earth together; procuring in spring, or early in summer, a quantity of fresh horse-dung, consisting of plenty of short stuff, and a due proportion of long; and casting the whole into a heap to ferment a fortnight or a month, that the rank burning vapour may pass away; then having some loamy earth, or other good substantial mould, or any spawny soil from old beds, form the dung into a long narrow ridge, mixing some of the earth occasionally towards the outside; and in a fortnight or three weeks, when the heat becomes quite moderate, covering the whole with dry long litter to defend it from the wet, permitting the whole to remain a considerable time, when good spawn will often be produced. The heaps for this use are best formed in dry sheds, &c.

In collecting it from any of these places, the lumps of dung and earth in which it appears should be taken up as entire as possible, put into a basket, and carried into some dry shed, or other place, when the heaps are made out of doors, till wanted, or it may be immediately used in making the beds.

The practice of introducing this sort of spawn, in a suitable manner, into beds properly formed and constructed for the reception of it, is the best and most convenient method, which has yet been found, of raising crops of mushrooms in garden cultivation. The beds for this use are, as has been seen, constantly prepared with new fresh horse-dung which has undergone the process of fermentation, by being thrown into a heap, in order to take off the first violent coarse heat, and then formed in the long narrow ridge manner, somewhat in the shape of a roof, for throwing off moisture, and left exposed in that state until it becomes in a proper state of heat, when the portions of spawny matter are inserted all over the surface, but only just within it, the whole moulded over an inch or two in thickness, and then covered closely with dry litter to a proper depth. The parts of the spawn are consequently planted in a sort of hot-bed, by means of which they rapidly advance in growth, and soon furnish supplies of good mushrooms for use. The spawn, being forced into action in this way, is often not longer than six or eight weeks in producing plentifully; the same bed frequently continuing to afford a supply for five or six months, or longer; but new beds are to be made every year, and sometimes two or three times in that space of time, in order to furnish a constant succession of good mushrooms. See *AGARICUS*, and *SPAWNING Mushroom-Beds*.

Where there is plenty of this fresh stable littery dung and the short stuff in mixture, mushrooms are sometimes not only abundantly supplied, but plenty of spawn for future beds.

No proper seed of the mushroom has hitherto been discovered by which crops of it can be raised by the gardener, though it is well known that it produces seed like other plants, and is naturally produced in that way, as well as by spawn. The extremely minute seeds are said, in this case, to be situated and contained in the *lamellæ* or gills, which, when full grown, and the seeds become quite ripe, discharge and disperse them upon the surrounding ground, from which they are conveyed by the wind and other means to other distant situations, where the soils are suited to their growth. In these they fix themselves and grow, their roots increasing rapidly so as to produce proper spawn.

The situations in which proper supplies of good spawn are to be met with, as well as the formation of it, will in some measure be seen from what has been said. That which is produced in the horse-dung methods is, however, constantly to be preferred to such as is procured from the field, for all the purposes of cultivation in the garden, as producing thicker, firmer, more fleshy, and richer flavoured mushrooms. All old worn-out spawn should, of course, be rejected, as improper and unfit for being made use of in this culture, and the new virgin spawn, as it is termed, or such as has not been in production of mushroom crops, be employed, as in some instances, even the young offspring spawn of such as has been long wrought from bed to bed, will degenerate; there being not unfrequently a very material difference in the goodness of that which is fresh and full of heart, and that which has been long in use, the former producing fine and abundant crops, while the latter only sends up a flash of small trifling heads at first, of none or very little substance, and perhaps no more of any consequence afterwards.

New littery and plenty of short horse-dung, especially when mixed with a little loamy earth, are the most remarkably and abundantly productive of good spawn. When they have lain together for a considerable length of time, they are mostly in a peculiarly fit state for producing it in large quantities.

Spawn of this sort keeps well when laid up close in a dry place, or when put up in hampers or baskets, and covered in a close thick manner by dry litter or mats. The drier it is put up and kept within moderate limits the better, as the more it will improve in its productive properties, and take more freely in the beds when planted, retaining its vegetative qualities for many months.

As this sort of spawn is of great importance and value in many places, where large quantities of mushrooms are raised for sale in the markets, certain persons in such situations often employ themselves at particular seasons of the year, but especially in the autumn, in going about to different parts and collecting it, which near large towns mostly pays them well, being of ready sale at a high price, as six or seven shillings the bushel, and more in some cases.

When it is to be provided in the vicinity of the metropolis, it will commonly be met with in the most ready manner at the neat-house gardens on the different side of it, at the different markets in it, where vegetables are exposed for sale, and in the principal nursery garden grounds.

It is capable of being packed up and sent to any distance when necessary.

SPAWN, Fish, in *Rural Economy*, the oviparous or egg-like granulated substance which is deposited by female fishes, in order to its being impregnated by the more liquid femal matter of the males, and be thereby rendered productive of the young progeny or fry of the particular sort or kind.

Each sort of fish has its peculiar habit or economy in the performance and mode of depositing this material, as may be seen in the following article. Some sorts of fish are likewise much more productive of it than others, consequently more prolific. This is the case with the herring and the salmon, the former of which is only a fish that weighs from five to ten ounces, according to Harmer, but in which the spawa weighs 480 grains, and has the amazing number of 36,960 eggs, when examined about the month of October: the latter, though a much larger fish, is productive of spawn in a very high degree, the number of its ova being almost countless. And there are other
forts

forts of fish, which probably equal or out-number either of these, as the mackarel, sprat, and some others. It is necessary that fish should be as little as possible disturbed at the time of their depositing their spawn in the rivers, and on the banks of the sea-shores, or other places, as it may not only be prejudicial to them, but injurious in preventing the male fish from impregnating it in a proper manner.

SPAWNING of *Fish*, the act of depositing the raw, spawning, or oviparous matter of the female, and of its being impregnated by that of the male, for the purpose of breeding or producing their young. Most sorts of river-fish, and many of those of the sea-kind, produce their young progeny in this way. This operation or work of impregnation is accomplished in different manners as to the mode of its deposition, according to the nature and habits of the fish, and the seasons at which the spawning takes place. In those fishes which spawn in the more still and shallow waters during the spring and summer seasons, such, for instance, as those of the pike, bream, carp, perch, and some other kinds, it would seem to be most commonly the habit to deposit their spawn material on the leaves and vegetables which lie just below the surface of the water, which is in all probability the most favourable situation for it in different respects. While in those fishes which cast their spawn in the winter season, such as the salmon, trout, herring, and many other sorts, spots and places very near the sources or beginnings of rivers and streams, or the more rapid fresh-water currents, are mostly sought for and fixed upon in this intention, where there is a constant flow of fresh water, where all stagnation is prevented, and where the water is the most fully aerated, either in its natural situation or during its fall in rain, as being probably the most suitable and favourable for the purpose. A proper and suitable degree of warmth may also be necessary in this business.

In all other cases the fishes probably deposit their spawn material in such situations as are the most suitable to their particular economies, and where there is the necessary heat, as well as where the water is the most fully saturated and impregnated with air, as it is now well ascertained, that their impregnated spawn material do not produce young ones, any more than seeds vegetate, except where they are freely supplied with air. The fish in the egg or spawn, derives its oxygen from the air which is dissolved in the water that surrounds or flows over it, which, in the first of the above cases, is much supplied to the water by the leaves of the plants on which it is deposited, in performing their healthy functions; which also probably afford a better and more suitable situation for the male fishes impregnating it upon than any others: and in the latter case, it is gained from the perpetual flowings of such fresh and fully aerated waters over it, after it has been the most conveniently and effectually impregnated in such shallow parts, currents, and streamlets. It has indeed been suggested, that in this latter case, it is the instinct leading the fishes to provide a proper supply of air for their spawn material, which is to be deposited, that carries or forces them from the seas, lakes, and other similar situations, into mountainous countries; and which impels and induces them to move against the streams, as well as to endeavour and make efforts for overleaping weirs, cataracts, mill-dams, and other similar erections and works. See SEED.

The spawning and generation of fish was however formerly considered as of a very different nature, and as being performed in a very different manner. It is stated, in speaking of the herring, by the writer of a paper in the third

volume of the "Transactions of the Highland Society of Scotland," that a very singular and seemingly unphilosophical notion had been held with regard to the impregnation of the ova or eggs of fish, and which is not by any means the doctrine or hypothesis of yesterday, but which has prevailed in a greater or less degree, for upwards of two thousand years; that is, from the days of Herodotus, who in treating and speaking of the fish in the Nile, makes the following observation. "At the season of spawning they move in vast multitudes towards the sea, the males lead the way, and emit the engendering principle in their passage; this the females *absorb* as they follow, and in consequence conceive, and when their ova are deposited, they are consequently matured into fry." Beloe's Herod.

And strange and absurd as this supposition and process seem to be, it is asserted, it is said, to be the case by Linnæus, the most learned of all others in the science of animal history: he tenaciously affirms, it is maintained, that there can be no impregnation of the eggs of any animal out of the body, and that as fish have no organs of generation, that deficiency is made up for by adopting the system or notion of Herodotus. This absurd and unfounded notion has likewise, it is added, been attempted to be supported by Kalm, the friend and countryman of the above celebrated naturalist, on a story supposed to have been told by Franklin about two rivers in his province (New England in North America,) which fell into the sea nearly together; in one of which no herrings were ever taken, while in the other they were abundantly caught; the fish, when they come to deposit their spawn, always passing up that river without ever entering the other. In order to try to make the fish take to the other river, this person is said to have put out his nets and taken some of them, as they were coming up for spawning in the productive river. He is said to have taken "the *spawn out of them*, and to have carefully carried it across the land into the other river, where it was *hatched*, and the consequence was, that every year afterwards they caught more herrings in that river; and this is, it is said, still the case." But on inquiry in that country, the writer of the above paper remarks, both the river and the story were unknown to all who were inquired of about the matter.

The same story is since supposed to have been trumped up by a French writer of the name of Nouel, with this strong shade of difference; that the former *cuts* the ova out of the belly of the herring, while the latter says, that the spawn was collected from off plants, where it had been deposited. At one of the sittings of the National Institute in France, in the year 1799, a memoir was read by this member of instruction at Rouen, on the means and advantages of naturalizing the herring, a salt-water fish, in the water of the Seine, near its mouth, &c.; in which, after noticing the various means by which this may be accomplished, it is observed, that "herrings having been found ascending from the sea into one river of the American province, (noticed above,) while a single individual was never seen in another, separated from the other by a narrow tongue of land, and which also communicated with the sea, this philosopher (Dr. Franklin) took the *leaves off some plants on which the herrings had deposited their ova*, already fecundated, and conveyed them to the river which was deprived of the annual visit of these fish. The success of the experiment surpassed his expectation, the ova was completely productive, and the following year the river was peopled with a numerous shoal of herrings, which, since that time, continued to frequent it." Phil. Mag. vol. x. p. 163.

This account the writer of the above paper considers as evidently

evidently founded upon the former, and both, he thinks, come in a very questionable shape; however, the theory of the latter is supposed more rational, and not entirely against established facts; though it should be considered, he conceives, that the European herring is not a native of fresh water, and, as he thinks, never will be naturalized in such waters; but that the spawn of fishes, being fecundated in their own waters, may be transported; and when placed in the same homogeneous element upon leaves, sand, or other matters, where the sun and air, as we have seen above, can have free access, or a proper heat, with oxygen air, as has been shewn already, received, such ova, raw, or eggs, will be animated and become fry in the same time they would have done in their parent beds, cannot be doubted. This is a practice, it is said, which is well known in China; the Missionaries to which have noticed two or three things about it which are singular enough; the first of which is, that in the great river Yangtse Kyang, not far from the city Kyus-king-fu, in the province of Kyang-fi, a prodigious number of barks meet every year to buy the spawn of fishes. About May the people of the country dam up the river for nine or ten leagues together, in several places, with mats and hurdles, leaving only room enough for barks to pass, in order to stop the spawn, which they know how to distinguish at first sight, though the water is scarcely altered; with this water mixed with the spawn, they fill several vessels to sell to the merchants, who, at this season, arrive in great numbers to buy and transport it into divers provinces, taking care to have it stirred up from time to time: this water is sold by measure to such as have fish-ponds and pools belonging to their houses. The manner of propagating the gold-fish from spawn is likewise deserving of attentive consideration. Du Halde's Descrip. of China.

It is supposed by the writer of the paper, that herrings which cast their spawn in the winter months, without doubt deposit it on our shores; but whether upon gravel, sand, stones, fuci, or other plants, is not well ascertained; but thus far we know, it is said, that it cannot be in deep water, unless we suppose it to have such a buoyancy as to be within reach of the sun's genial influence, and, as has been since shewn, that of the free action of the air.

It is believed, and the same writer thinks with reason, that it is impregnated by the male after it is emitted by the spawner or spawning-fish. The raw spawn, or eggs, of these fish, become animated, it is said, in the month of April. It is noticed, that the *fucus palmatus*, and indeed all the numerous species of fuci which grow upon our coasts, it is hardly to be doubted, harbour the spawn of fishes; but that the opinion may readily be either confirmed or confuted by the assistance of a glass of moderate magnifying power.

It is suggested, likewise, that the cause or reason of the herring's quitting the deep seas, is unquestionably that of its casting its spawn in its native water, as the banks and mouths of the rivers where it was produced. And the same is the case with the salmon, the shad, the pilchard, and some others; all of which prefer their natal waters for the purpose of spawning in; and though the herring and pilchard sometimes deviate from this course, the salmon and shad do it very seldom, being more sober and steady in their attachment to their parent haunts. The heaviest salmon are met with in the large rivers, and the largest herrings in the deep waters, each coast and river producing fish which are different in taste, size, and appearance, as is remarkably seen in the shads and salmon of different rivers, and the herrings of different situations. The fry of the herring, as well as of the salmon, when

they have attained sufficient size and strength, quit the shallows and make for the deeps: when the shoals of the former enter the bays, and other similar places, the young ones are noticed to take their final departure from them.

The fecundity of different kinds of fishes is very different; but that of the herring and some others is very great. See SPAWN, *Fish*.

SPAWNING or *Laying Oyster-Beds*, the manner of preparing, distributing, and managing them, in the mouths of the breeding-rivers in particular counties and districts, as in Essex, and probably some others. The exact method of performing the business has not been described; but they are spawned or laid somewhat in the bed-manner. The principal rivers in the county of Essex, where this sort of work, or that of breeding oysters, is carried on, according to the Corrected Agricultural Report of that district, are those of the Crouch, the Blackwater, and the Coln; but the first is by far the most certain in produce of any of them. The beds, or layings, are made in the creeks, and other similar places, on the sides or parts which adjoin the mouths, openings, or beginnings of these rivers. It is from these rivers that the oyster-layings, or beds, are usually stocked; though some are constantly supplied from Portsmouth, or places in its neighbourhood, being brought in the largest sort of oyster-vessels, not only into this county, but Kent, where they are laid for the ensuing season. The Colchester oyster-beds are chiefly at Wivenhoe, being partly supplied by the Kentish oyster-smacks. The beds, or layings, in these different situations, are likewise, in all probability, supplied or furnished with oysters from several other places on the southern coast of this country, as well as the northern one of France.

The breeding-rivers in the county of Essex are said to be very uncertain as to the quantity of oysters they produce; as in some seasons they afford a great quantity, while at other times they only produce what is called a good sprinkling, and sometimes there is none at all. But they seldom all produce or fail, it is observed, in the same season. See OYSTER and *Oyster-Fishery*.

The oyster-fisheries, in different places, are of very great importance to the country at large, as well as to particular counties and districts, especially that of Essex; as they employ great numbers of small vessels, require the labour of many men, and afford considerable profit in the produce of food which they supply, as being principally an article of luxury. In the county just mentioned there are several of these oyster-fisheries. In the Blackwater river and neighbouring parts, there is a considerable fishery of this nature; and West-Mersea is one of the principal stations of the dredgers: above thirty boats, it is said, belong to the island, and are almost constantly at work in this business. Vessels come from Kent to purchase the oysters, and they sell some to Wivenhoe, where what are called the Colchester beds are situated. They are sold by the tub of two bushels, and are generally from 4s. to 6s. a tub; but at present (1807) 6s. A dredging-boat is from fourteen to thirty or forty tons burthen: all are decked and built at Wivenhoe, Brightlingsea, and places thereabouts. The price is 10l. a ton for the hull of the vessel only; the fitting out of one of twenty tons requiring the amount of 150l. From two to four men are required for each vessel, who are paid by shares; and the master has a share for the vessel. In the spring season they go to dredge on the coasts of Hants and Dorset. Sometimes one hundred and thirty vessels have been counted at work within sight of Mersea. This oyster-fishery is, it is said, an object of considerable consequence to the country, from the earnings

being great, and some other circumstances: but when the men die, their families, it is said, come to the parish, greatly increased by the number of apprentices which they have taken. Nothing, however, the writer of the report thinks, can be so preposterous as a police of the poor, which permits the benefits of commerce and manufactures to load the land with rates to the amount of 8*s.* in the pound, when a very small contribution by a box-club, or benefit society, would readily prevent the evil. See SOCIETIES, *Friendly*.

The following interesting account of the oyster-busines in the same district, is from Mr. Bennet Hawes of Mersea, given as from his own local knowledge of the places where it is carried on, in the above report. The number of vessels which are employed in it, of from eight to forty or fifty tons, is nearly two hundred, in which are employed from four hundred to five hundred men and boys. A vessel carrying three men has one share and a half of all the earnings, and the men one share each. Large vessels have generally, it is said, two shares; but none, it is believed, more than this.

It is said that the vessels which are built at East Donyland, Wivenhoe, Brightlingsea, Burnham, and Mersea, for this business, will last from thirty to forty years, when proper care is taken of them. The writer was informed by a person then living at Wivenhoe, that he had, within the last twenty years, built one hundred vessels for the oyster business alone.

There has been an increase of boats, and of course of men, of more than one half within the last thirty years.

At Burnham they have seven dredging smacks, belonging to the company that hire the river of Sir Henry Mildmay, besides four other private ones, and some smaller vessels. The smacks are from eighteen to twenty tons. And there are only about one hundred fishermen and sailors about the place, which are much too few, it is thought, for so fine a river.

Most of the vessels of sixteen tons and upwards, go, it is said, to Portsmouth, or places adjacent, in the month of March, to catch and carry oysters; those under twenty-five tons being employed in catching them, and the larger ones in carrying them into this county and Kent, to be used as noticed above; they generally return from thence in the month of June, when the large ones go after mackerel, herrings, and sprats, during the latter part of the summer, and in the ensuing winter, the smaller ones to the catching of oysters in the breeding rivers, as above.

The oysters are sold to London, Hamburgh, Bremen, and, in time of peace, to Holland, France, and Flanders.

The price has varied but little for these last ten years.

The quantity consumed in a season is scarcely to be calculated; but it is supposed that it cannot be less than 12,000 or 15,000 bushels.

This sort of fishery is so much blended with the others, that it is almost impossible to state the capital which is employed in it, but it is supposed to be from 60,000*l.* to 80,000*l.*

SPAWNING Mushroom-Beds, in *Gardening*, the practice of planting or putting the mushroom spawn into the beds or ridges formed for raising crops of this sort. It is performed in several different manners, as by putting it into the dungy matter immediately below the surface of the beds, which is called spawning in the dung; by depositing it upon the surface of the dung, which is termed spawning on the surface; and by placing it in the mould by which the beds have been previously covered, which is denominated spawning in the earth. In all these modes of performing the work of spawning the beds, they are afterwards

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to be earthed or moulded over in a neat even manner, with finely reduced rich, loamy, mellow, dry, mouldy earth, so as to perfectly cover in the planted spawnly substance, this being done in the two first methods of planting, to a much greater depth than in the last mode, where an earthy coat, or casing, has been before supplied; an inch and a half, or two inches in depth of mould, being necessary in the former cases, while an inch or less may be fully sufficient in the latter case. The spawn is properly divided into pieces, and put into the beds in all these modes in a regular manner, at narrow distances, both in the rows and spaces between them, as about six or seven inches in each, over the whole of the different sides and ends of them. There is little difference in these modes of putting in the spawn, except that in the two first, and especially in the second, it can be laid in rather more closely than in the last, by which means, sometimes, a more forward and plentiful supply of mushrooms is produced.

After the earthing has been properly accomplished in these different cases, the beds are ready for the reception of the straw coverings, as no light is ever requisite in the growth of these crops. These straw coverings should invariably be applied as soon as ever the state of the beds, in regard to the heat they produce and retain, will permit, after the spawning of them is finished. It should be done to a considerable thickness, especially where the beds are not in sheds, but exposed to the effects of the weather, in order to afford the spawn a proper degree of heat and full protection. Such strawy littery materials may be gradually shook upon them, from the thickness of half a foot, to such depths as are sufficient to produce a suitable warmth for promoting the growth of the spawnly material. They are to be lightly and regularly shaken on over the whole, and to remain constantly, having in some cases other sorts of coverings laid over them, as no sort of moisture must come near the spawn in these cases.

As little exposure to the full air as possible, after spawning the beds, should take place in performing any sort of work about them, as there is much injury and check produced by it in the growth of the spawn, and, of course, in the crops to be raised by it.

The proper running and knitting of the spawn, which may be seen by turning up a little of the strawy coverings, shews the spawning of the beds to have been successfully performed; but this should not be judged of too hastily, as this sort of spawn is sometimes slow in coming into an active state of vegetation. There is also a fine full smell of the mushroom in all such cases. See *AGARICUS*.

SPAWS, mineral waters arising out of the earth; impregnated with nitre, sulphur, alum, bitumen, coppers, or other mineral matter, in passing through the strata thereof; and hence endued with some medicinal qualities, cathartic, diuretic, emetic, alterant, or the like. See *MINERAL WATERS* and *SPA*.

SPAX, a name given by some authors to the common tænia, a small fish of the anguilliform kind, frequent on the shores of Italy.

SPAYING, in *Rural Economy*, the operation of cutting, castrating, or removing the female parts of different kinds of animals, as sows, heifers, mares, &c. in order to prevent any future conception, and promote their fattening. It is usually performed by cutting them in the mid-flank, on the left side, with a sharp knife or lancet, in order to extirpate or cut off the parts destined to conception, and then slitting up the wound, anointing the part with tar-salve, and keeping the animal warm for two or three days. The general way is to make the incision in a sloping manner, two inches

SPAYING.

and a half long, that the fore-finger may be put in towards the back, to feel for the ovaries, which are two kernels as big as acorns, one on each side of the uterus, one of which being drawn to the wound, the cord or string is cut, and thus both taken out.

It may be noticed, that in the Annals of Agriculture, Mr. Foot has suggested the practice of spaying old cows and heifers; as it is a method, he apprehends, that might be performed with safety, and prove of general use in grazing; as cows, when they grow old and fail in their milk, are often attended with difficulty, where the bull goes at large, to keep them from him, especially on commons, during the summer, which put him on trying the experiment on a cow of small value, whose profit for the pail was so far over, that she would not milk for about three months before she became dry. After she had calved about a month, he had her cut; the operator was an ingenious person, and performed the business well, that with a little care of keeping her from the cold (being early in the spring) for about a fortnight he thought her out of danger; and continued milking her as usual all the time. She soon began to thrive, gaining flesh, and before the summer was over, by the time she was quite dry, was much improved, though kept no better than the other part of the dairy on very middling pasturage. At Michaelmas, had she been put to turnips, or good rouse, she would have been fat by Christmas, or soon after. When killed, she sold at 3s. 6d. a stone, about half fat at that time, which he laid at one shilling a stone more than she would have done had she not been cut. And afterwards he had two others cut, that continued to be milked, and grazed well; one he had killed, the other he sold alive, which improved and paid beyond expectation. And though little has yet been done in this way, he is persuaded it will be found of general utility, if attended to. But, however, lately he accidentally met the person that performed the operation, who informed him that he had been sent for within twelve months, or thereabouts, to cut near forty in like manner, which having all done well, none failed; that there appears little or no danger in the case; and he believes it may be found of great advantage to the grazier and farmer, if they are inclined to practise it, as well as to the public at large. In confirmation of the above, the persons who have tried the experiment are, he is informed, William Colhoun, esq. Norfolk, who has cut eight; Mr. Martin, Exning, Suffolk, who has cut six; Mr. Cayson, Chippenham, who has had the operation performed on twenty; and Mr. Robinson, Eriswell, who has performed it on four or six.

And he may further add, that most of these were young heifers between two and three years old (some old cows), that had not taken bull; the young stock appears to thrive apace, and grow in size, as well as to be likely to answer for the butcher soon; they may be fattened with turnips in the winter, or kept on another summer, as the grazier pleases. And in Yorkshire it is very common to fatten their heifers at three years old, which answer as great a purpose for grazing, and are more profitable than older steers or heifers, &c. but those are kept from the bull.

Farther, although there is a method generally practised in spaying calves that are intended for heifers of that name, which are usually cut about six weeks or two months old, yet this other method of treatment, he thinks, is preferable and not so dangerous, for the two-years old beasts may be supposed stronger and more fit to undergo the operation; and, in the next place, it is performed quite differently; what is cut away, is only the ends of what is termed the *lusts*, or generative parts, which are not, when separated from the other parts, bigger than the end of a man's thumb to the

first joint, that makes the operation less painful and dangerous when rightly performed. But he would not advise every butcher, or inexperienced artist, to undertake what they do not understand. He thinks this observation is due to the operators, who have cut upwards of forty head of cow-stock in this manner, (as they informed him,) which have all done, and are doing, well, and he recommends them to public encouragement in an art that is likely to be attended with general utility to the public. They are William Bailey and son, Lakenheath, Suffolk. He may further observe, that a heifer at two or three years old may be defective in the bag, in the loss of teats, or those of small size, not larger than an ewe's, which seldom are profitable for the pail, which may be cut after this mode and grazed.

And Mr. Marshall, in his Rural Economy of Yorkshire, remarks, that it is a fact well established in the common practice of that district, that spayed heifers work better, and have, in general, more wind, than oxen; and it is not doubted that spayed mares would have an equal preference to geldings. The reason held out against this practice, though formidable at first sight, proves a mere shadow on examination. The spaying of fillies would undoubtedly spoil them for brood mares. But does not the gelding of a colt spoil him for a stallion? What breeder, when his mares foal, wishes for fillies? and what dealer would not give 2s. 6d. for each, to have his mares changed into geldings, or perhaps into animals superior to geldings? Besides, in the spring of the year, open mares are faint and troublesome. The only requisites appear to be a safe cutter, and a man of spirit to set him to work, to bring the spaying of female foals into common practice; and it does not follow that, because a part of the female foals should be cut, there would not be open mares to breed from; more than it does, that because some heifers are spayed for the yoke, or for fattening, there are not cows sufficient for the purposes of breeding, and the dairy. He does not mean, however, to recommend a practice of which he has had no experience; but if the experiment has not been tried, it strikes him forcibly, that it is worth the trial; and that it is more than time it were set about. Since this, he however states; that it had been tried in the southern districts, as he saw a mare in 1791, then rising five or six years old, which had been spayed at eight days old by a colt-cutter in the neighbourhood of Petworth; and that she was a well-bred mare, and of a size proper for hunting. The farmer to whom she belonged asked seventy guineas for her, a proof that in his estimation, at least, she had not been injured by the operation. And it is probable, that this practice had been attempted long before that period. See CATTLE.

There can be no doubt but that the notion of injury being done by the spaying of female animals is wholly erroneous, and without any foundation in truth or correct observation, as the experience of every day shews it to be so in the most full and satisfactory manner. The chief reason why a practice, which is beneficial in so many points of view to the interests and advantages of the farmer, has been so little attended to, is the difficulty which is constantly experienced from the want of a sufficient number of expert and proper persons for performing the operation. Such persons are far from being common in any, much less in every district, as some knowledge of a nature which is not readily acquired, and much experience in the practice of cutting, are indispensably necessary to the success of the undertaking. Whenever, however, the utility and benefits of the practice become better understood and more fully appreciated by the farmer, and the operators more numerous, much greater attention

and importance will be bestowed upon it, as it is capable of relieving him from much trouble, of greatly promoting his profits, and of benefiting him in a variety of ways. The facts are long since well proved and ascertained, that animals which have undergone this operation, are more disposed to feed or take on flesh, more quiet in their habits, and capable of being managed with much greater ease and facility in any way whatever, than they were before it was performed. It may also have advantages in other ways, in different sorts of animals; it may render the filly, in the horse kind, nearly equal to the gelt colt for several different uses; and the heifer, in the neat cattle kind, nearly equal to the ox, for all sorts of farm-labour. The females of some other sorts of animals may likewise, by this means, be made to nearly equal the castrated males in usefulness for a variety of purposes and intentions; and in all cases be rendered a good deal more valuable, or manageable, than they are in the present custom which prevails with them.

SPAYING of Fish. See *Castration of Fish.*

SPEAKER of the House of Commons, a member of the house, elected by a majority of the votes, to act as chairman, or president, in putting questions, reading briefs or bills, keeping order, reprimanding the refractory, adjourning the house, &c.

The first thing done by the commons upon the first meeting of a parliament is to choose a speaker, who is to be approved of by the king; and who, upon his admission, begs his majesty, that the commons, during their sitting, may have *free access to his majesty, freedom of speech in their own house, and security from arrests.* See **PARLIAMENT.**

The speaker is not allowed to persuade, or dissuade, in passing of a bill, but only to make a short and plain narrative; nor to vote, unless the house be equally divided. The lord chancellor, or keeper, or any other appointed by the king's commission, is usually *speaker of the house of lords*; and if none be thus appointed, the house of lords (it is said) may elect. The speaker of the house of lords, if a lord of parliament, may give his opinion, or argue any question in the house.

The *speaker of the convocation* is called *prolocutor.*

SPEAKER is used by *rhetorical* writers in the same sense with orator. See **ORATORY.** See also **ELOCUTION, PRO-NUNCIATION, and ACTION.**

As to the character and address of an orator, it is necessary that every thing appear easy and natural, and the disposition of the speaker be discovered by his words: thus would he express what Quintilian calls a propriety of manners: accordingly, the ancient rhetoricians made it a necessary qualification in an orator, to be a good man; since he should always be consistent with himself, or, as we say, talk in character. There are four qualifications more especially suited to the character of an orator, which should always appear in his discourses, in order to render what he says acceptable to his hearers; these are wisdom, integrity, benevolence, and modesty. See an illustration and enforcement of them in Ward's *Orat.* vol. i. lect. 10.

SPEAKING, the art, or act, of expressing one's thoughts in articulate sounds or words.

Pliny, Ælian, Plutarch, and other authors, make mention of several bealls that have spoken: and Pliny himself speaks with assurance, in his history, of an ox that spoke. Philostratus, in his life of Apollonius, gives the like quality to an elm, and even to ships. Homer makes Xanthos, one of Achilles's horses, speak; in which he has been followed by Oppian. But these are all fabulous stories; we have much better authority for a serpent and an ass's speaking, un-

less the cases here referred to be allegorical. See **LANGUAGE.**

SPEAKING-Trumpet. See **TRUMPET, and STENTOROPHONIC.**

SPEAN, in *Geography*, a river of Scotland, which forms a communication between loch Laggan and loch Lochly.

SPEAR, in *Armoury.* See **LANCE.**

SPEAR, in the *Manege.* The feather of a horse, called the *stroke of the spear*, is a mark in the neck, or near the shoulder of some Barbs, and some Turkey and Spanish horses, representing the blow or cut of a spear in those places, with some resemblance of a scar. This feather is an infallible sign of a good horse.

SPEAR-Hand, or *sword-hand* of a horseman, is his right hand.

SPEAR-Foot, of a horse, is the far-foot behind. See **FAR.**

SPEAR, King's, in *Botany.* See **ASPHODELUS.**

SPEAR-Thistle, in *Agriculture*, a plant of the weed kind, which is often troublesome in land. It is a biennial, and of course readily destroyed by taking care to have it mown down or cut over before the time of its perfecting its seeds. It is not unfrequently termed the bur-thistle.

SPEARMINT, in *Botany.* See **MENTHA.**

SPEARWORT, the English name of the *ranunculus flammæus.*

This is with us generally esteemed a poison, but the Scots use it as a medicine. They beat it, and squeeze out the juice, which they take as a purge, drinking a little melted butter or oil before and after it, to prevent its taking the skin off from the throat. It operates very violently, but with robust constitutions it does very well.

They use it also externally in cases of pain in the head, or any other part of the body. They bruise the leaves to a sort of paste, and apply them to the part; they soon raise a blister, and a large quantity of water is discharged, after which the pain goes off. This is a short way of blistering, and answers as safely and as well as our's by the cantharides: but it is a wonder that people, who see this quality in the plant, should dare to take it into their mouths and stomachs.

Spearwort is very prejudicial to sheep, as causing the rot. It is also troublesome in lands of the more wet kinds.

SPECIA, in *Geography*, an island in the Grecian Archipelago, about 10 miles in circumference, at the entrance of the gulf of Napoli. N. lat. 37° 15'. E. long. 23° 23'.

SPECIA Poulo, a small island near the south coast of Specia.

SPECIAL, something that is particular, or has a particular designation; from the Latin *species*: in opposition to *general*, of *genus*. See **GENERAL, PARTICULAR, SPECIES, and GENUS.**

The king, in his letters, frequently says, of our special grace, full power, and royal authority.

SPECIAL Assise, Attorney, Bail, Case, Fee-tail, Issue, Jury, Plea, Session, Statute, Verdict, and Warrant. See the articles.

SPECIALTY, in *Law*, is most commonly taken for a bond, bill, or other instrument in writing. Accordingly, debts by specialty, or special contract, are such by which a sum of money becomes, or is acknowledged to be, due by deed or instrument under seal: such as by deed of covenant, by deed of sale, by lease reserving rent, or by bond or obligation. These are looked upon as the next class of debts after those of record, being confirmed by special evidence under seal.

SPECIE, in *Commerce*, gold and silver coin, distinguished

guished from paper-money; but in Germany, the word specie is applied to the rix-dollar, and its divisions, as coined after the rate of the empire.

SPECIES, an idea, which relates to some other more general one, or is comprised under a more universal division of a genus; as in the definition of any thing, we obtain its general nature or genus, by comparing it with other things that are most like to itself, and observing wherein its essence or nature agrees with them; so we obtain the essential or specific difference, by considering the most remarkable and primary attribute, property, or idea, in which this differs from those other things that are most like it: and this attribute, or specific difference, distinguishes each species from one another, while they stand ranked under the same genus.

The word is Latin, formed from the ancient verb *specio*, *I see*; as if a species of things were a collection of all the things seen at one view.

Species is a mere term of relation: and the same idea may be a species, when compared to another more general one; and a genus, with regard to a more particular one. Thus body is a genus, with regard to an animate and inanimate body; and a species, with regard to substance.

The last species is that which can only be divided into individuals.

Animal is a species, with regard to body; and man is a species, with regard to animal. God destroyed mankind by the deluge; but he preserved the species.

SPECIES, in *Logic*, is one of the five words, called by Porphyry, *universals*.

SPECIES, in *Rhetoric*, is that which comprehends under it all the individuals of the same nature. From hence, we may argue; he is a man, therefore he has a rational soul. And orators sometimes take occasion to descend from the thesis or genus, to the hypothesis or species; that is, in treating upon what is more general to introduce some particular contained under it, for the better illustration of the general.

SPECIES, in the *Ancient Music*, denotes a subdivision of one of the genera.

The genera of music were three, the enharmonic, chromatic, and diatonic; the two last of which were variously subdivided into species: nor was the first without species, though those had not particular names, as the species of the other two had. These species were also called the *chroai*, colours of the genera. See GENUS.

SPECIES is also applied, by ancient musicians, to the different dispositions of the tones and semitones in a fourth, fifth, or octave. Hence they say there are three species of fourths, four of fifths, seven of octaves. Wallis's *Append. Ptolem. Harm.* p. 171.

The Grecians expressed this sense of the term species by *ιδος*, or by *σχημα*. The Latin word, *figura*, has also been taken in the same sense. *Aristox.* p. 6, 74. *Ed. Meib.* Wallis, *ibid.* p. 170.

SPECIES, in *Optics*, the image painted on the retina by the rays of light reflected from the several points of the surface of an object, received in at the pupilla, and collected in their passage through the crystalline, &c.

Philosophers have been in great doubt, whether the species of objects, which give the soul an occasion of seeing, are an effusion of the substance of the body; or a mere impression which they make on all ambient bodies, and which these all reflect, when in a proper distance and disposition; or, lastly, whether they are not some other more subtle body, as light, which receives all these impressions from bodies, and is continually sent and returned from one to another, with the

different figures and impressions it has taken. But the moderns have decided this point by their invention of artificial eyes, in which the species of objects are received on a paper or linen cloth, in the same manner as they are received in the natural eye. The ancients have distinguished the species, by which objects become visible, into *impressa* and *expressa*. The former are such as come from without, or are sent from the object to the organ; such are those we have already been speaking of. And the latter are those, on the contrary, which proceed from within; or that are sent from the organ to the object.

Le Clerc, in his system of vision, by one of those revolutions very frequent in philosophical opinions, has called upon the stage again the species *expressa* of the ancient philosophers. For, according to him, it is not by species or images impressed on the optic nerve, that the soul sees objects; but by rays, which she herself directs to them, and which she uses as a blind man does his staff, to grope out objects.

The Peripatetics account for vision, from a kind of *intentional* species, thus: every object, say they, expresses a perfect image of itself on the air next to it. This expresses another less one on the air next to that; and this a third still less. Thus are the images continued from the object to the crystalline, which these philosophers hold the principal organ of seeing. These they call *species intentionales*; and to account the better for their generation, they affirm, that objects exhibit them in the same manner, as mirrors do a man's face. See VISION.

SPECIES, in *Theology*, denote the appearances of the bread and wine in the sacrament after consecration. Or, as the Romanists define them, the accidents remaining in the bread and wine, by which they become sensible to us, after their substance is destroyed.

The species of the bread, &c. are its whiteness, quantity, figure, friableness, &c. Of wine, its flavour, quickness, specific gravity, &c.

The generality of Romish divines hold, that the species are absolute accidents. And the Cartesians, who are bound to deny any such things as absolute accidents, are greatly puzzled to explain the species, without incurring the censure of heresy. F. Magnan is forced to assert, that the species are mere delusions and appearances, which God impresses on our senses.

SPECIES, in *Commerce*, are the several pieces of gold, silver, copper, &c. which, having passed their full preparation and coinage, are current in public.

SPECIES, *Decried*, or *cried down*, are such as the sovereign has forbidden to be received in payment.

SPECIES, *Light*, are those which fall short of the weight prescribed by law.

The weights of the current coins, as coined, are now as follow; the standard of gold being *3l. 17s. 10½d. per oz.* the mint price of gold; and the standard of silver being *5s. 2d. per oz.* mint price of silver.

	dwt. grs.
Gold, guinea - - - - -	5 9½
half-guinea - - - - -	2 16¾
Silver, crown - - - - -	19 8½
half-crown - - - - -	9 16¼
shilling - - - - -	4 20
sixpence - - - - -	2 10

The current weight of gold:

Guinea - - - - -	5 8
Half ditto - - - - -	2 16
	Under

Under this weight no gold was allowed to pass by proclamation.

SPECIES, False, are those of different metal or alloy from what they should be, &c.

SPECIES, in *Algebra*, are the symbols, or characters, by which quantities are represented.

SPECIES Aromaticæ, a new name given in the late London Dispensatory to the composition usually called *species diambra*. The College observed, that the intention of this medicine was best answered, by composing it of such spices as the daily experience of the table shews were most grateful to the stomach, and by avoiding all ingredients which, though of the aromatic kind, are accompanied with any thing nauseous and disgustful in their flavour; and, therefore, have ordered it to be now made in the following manner. Take cinnamon two ounces, cardamom-seeds, ginger, and long pepper, of each an ounce; make all together into a fine powder.

SPECIES e Scordio, the ingredients of the diascordium electuary in a dry form. The recipe is something altered in the late London Pharmacopœia, and stands thus: take bole armenic, four ounces; scordium, two ounces; cinnamon, an ounce and half; storax, roots of tormentil, bistort, gentian, dittany of Crete, galbanum, and gum arabic and red roses, each an ounce; long pepper and ginger, each half an ounce; opium, three drachms; this may be left out at pleasure; and all are to be beat to a fine powder.

SPECIES, in *Gardening*, has some which consist only of one, as the flowering rush, the hop, and some more; while in others they are numerous, as in the sun-flower, the geranium, the honeysuckle, the willow, and a great many more. There is often, too, some degree of similarity in the culinary or domestic and economical uses, as well as the medicinal properties, in the species of cultivated garden and other plants, which belong to the same genus or family, as in the cases of garlic, onion, leek, shallot, and chives; cabbages, favoys, brocoli, and cauliflower; parsley and celery; the bay-tree, benjamin-tree, saffras, and cinnamon; mugwort, wormwood, tarragon, and southernwood: and the same takes place in many other instances.

The species likewise, in some cases, serves to denote the mode of culture and management which are necessary in the raising and growing of different plants, in the garden manner, as well as their habits of growth and production.

SPECIES of Plants, in *Systematic Botany*, appear, as far as can be ascertained from the universal experience of those who are conversant with them, as well as from every thing that can be gathered from the records of remote antiquity, to remain distinct from each other, marked by their appropriate characters and qualities, and renewing themselves periodically by sexual generation. Such being the case with all the plants of which we have any knowledge, we conclude it to be so with the rest, as well as with animals. The White Blackbird of Aristotle still inhabits the Cyprian groves and copses of Arcadia, undisturbed by the revolutions of two thousand years; and we doubt not that the banks of the Alpheus have been fringed with the same violets and primroses, through uncounted ages, as those with which they are now, every spring, adorned.

Various plants indeed, and especially domestic ones, like domestic animals, are found liable to some variations of colour, luxuriance, and sensible qualities, which have led curious inquirers to doubt whether any species are certainly permanent. This doubt could arise only from a slight view of the subject. Whatever casual aberrations there may be in the seminal offspring of cultivated plants; a little observation will prove how transient such varieties are, and how

uniformly their descendants, if they be capable of producing any, resume the natural characters of the species to which they belong. Nothing can better exemplify this fact, than the series of experiments instituted, on a most extensive scale, upon the Apple-tree, by the celebrated president of the Horticultural Society, Mr. Andrew Knight. They prove that every thing but sexual propagation is only the extension of an individual, whose corporeal frame has but a certain limited existence; the period of which is indeed much longer in some varieties than in others; and hence the valuable Golden-pippin and Nonpareil have enriched our orchards for a long course of years, while numerous new varieties of apples are found to endure but for a few seasons. Some, however, promise to be more lasting, and to supply the place to our descendants, of those kinds, of which we can transmit to them only the names. When varieties originate in the cross impregnation of plants of different species, they partake of the inability to procreate which belongs to mule animals, and are moreover seldom capable of being long increased by cuttings, budding, or other methods. For confirmation of this, see the article *PELAGONIUM*.

The technical discrimination of the species of plants, but vaguely and superficially attended to by the ancients, makes an interesting part of the philosophy of modern botany, which considers their differences as indisputably founded in nature, and for the most part extends that opinion, even to those assemblages of species which we term *genera*. On this subject the reader may consult the article *GENUS*.

Although the distinctive characters of genera are wisely limited, by the most philosophical botanists, to the parts of fructification, those of species are allowed to be taken from any part of the plant. Some characters are found more important or constant in one tribe, others in another; none are absolute, or invariably constant, in any. Number, which in the natural orders of *Caryophylleæ* and *Rosicææ* will sometimes afford even a generic distinction, in others, and even in what regards the stamens of the *Caryophylleæ* themselves, will hardly be found to limit a species. The differences between simple or compound leaves, entire or indented, opposite or alternate ones, are usually striking and unchangeable; but exceptions may be found to all these. Colour of flowers is, on the other hand, seldom to be relied on as a specific difference. It appears so in *Mesembryanthemum*, but to prove it the species must be cultivated from seed. Yet the yellow disk of a compound flower has never been known to change hues with its blue or white radius, nor does such a variation seem within the bounds of possibility. Pubescence is found variable both in its structure and quantity; but less, or not at all, so in direction. Hence the specific characters of *Mentha*, and more recently of the genus *Myosotis*, have been determined better than by any other means.

The inflorescence, or mode of connection of the flowers, is pointed out by Linnæus, as yielding the best specific characters; though he, in theory at least, excludes it from all authority in founding genera. In grasses, nevertheless, every body recurs to this mark; though perhaps sounder principles may hereafter be discovered for arranging even these.

The root almost invariably affords good and unchangeable specific characters; but it is not always accessible, nor readily preserved in a herbarium. Some grasses moreover change their fibrous roots into bulbous ones, in consequence of a fluctuation of soil or nutriment; and the bulbs of other plants very much alter their texture or appearance from similar causes.

Great experience and sagacity, with perhaps a peculiar talent, are requisite to form a good judge of specific characters. To convey a precise idea of them to others, requires a clearness of definition, and a command of language, granted to very few. Linnæus, with good reason, limits such characters to a certain number of words, hardly exceeding twelve. However narrow these bounds may appear, we believe them to be in general, if not always, sufficient; and every person will perceive that the consequence of their transgression is usually feebleness, if not confusion, of definition. It must always be remembered that specific characters are *differences*, not *descriptions*. Hence a specific character for a solitary species of any genus, is an absurdity. It cannot contrast such a species with what are unknown, or perhaps do not exist. A short description may be very commodious or satisfactory to give an idea of the plant, especially if the author mistrusts his genus or its definition; but if the genus be good, the very characters which he will select to delineate the habit, or prominent peculiarities, of the only known species, will, most likely, be common to any new ones that may subsequently be discovered.

Linnæus remarks, that the detection of genuine specific distinctions is the summit of botanical skill. To which we may add, that those have most excelled in this department who have caught the greatest share of the genius of this great man, whose definitions come as near to perfection as art can come to nature.

SPECIFIC, in *Philosophy*, that which is proper and peculiar to any thing; or that characterizes it, and distinguishes it from every other thing. See **PROPER**, &c.

Thus, the attracting of iron is specific to the load-stone, or is a specific property of the load-stone. A just definition should contain the specific notion of the thing defined, or that which specifies and distinguishes it from every thing else.

SPECIFIC, in *Medicine*, such articles in the materia medica as have the special power of curing particular diseases, in all persons, and under all circumstances, without demanding any attention to particular indications. In other words, a *specific* is a certain antidote against a given disease. Notwithstanding, however, the multitude of such specifics, which are every day announced by boasting quacks, and testified to by all ranks of people, who are their dupes, it unfortunately happens that no such remedies exist. As sound science has extended, all these vaunted specifics have successively been banished from the confidence of men of sense and information; and almost every remedy has some obvious action upon the animal system, so that the principles of its operation in particular diseases may be pointed out. Peruvian bark was formerly supposed to be a specific for intermittents and agues; but it is now known to fail in many cases, and not to be more efficacious than other medicines of a tonic power, such as arsenic, and some combinations of bitters with aromatics, which are popularly used in agueish countries. The two medicines which approach the nearest in their qualities to the character of *specifics*, are *mercury*, as the antidote to the venereal poison, and *sulphur*, to that of the itch. Indeed it is only in cases of the actual existence of a morbid poison, that any distinct antidote can possibly exist. But even with respect to these two medicines, it is well ascertained that there are cases of disease, so accurately resembling lues venerea, as not to be distinguishable by the most acute and experienced eye, which nevertheless recover without the aid of mercury (see Mr. Abernethy's "Account of Diseases which strikingly resemble the Venereal Disease"); and we know that the powers of sulphur in curing the itch are considerably augmented by the addition

of other substances, such as hellebore, muriate of ammonia, the white oxyd of mercury, &c. All other instances of pretended specifics are impositions.

SPECIFIC Gravity, in *Hydrostatics*. See **SPECIFIC GRAVITY**.

SPECIFIC Gravity of Living Men. Mr. Robertson, in order to determine the specific gravity of men, prepared a cistern, 78 inches long, 30 inches wide, and 30 inches deep; and having procured 10 men for his purpose, the height of each was taken, and his weight; and afterwards they plunged successively into the cistern. A ruler, graduated to inches and decimal parts of an inch, was fixed to one end of the cistern, and the height of the water noted before each man went in, and to what height it rose when he immersed himself under its surface.

The following table contains the several results of his experiments.

No. of Men.	Height.	Weight.	Height of Water before immersed.	Height of Water when immersed.	Water raised.	Solidity.	Weight of Water.
	Ft. In.	Pounds.	In.	In.	In.		Pounds.
1	6 2	161	19.30	21.20	1.90	2.573	160.8
2	5 10 $\frac{3}{8}$	147	19.25	21.16	1.91	2.586	161.6
3	5 0 $\frac{7}{8}$	156	19.21	21.06	1.85	2.505	156.6
4	5 6 $\frac{1}{4}$	140	19.17	21.21	2.04	2.763	172.6
5	5 5 $\frac{2}{8}$	158	19.13	21.21	2.08	2.817	176.0
6	5 5 $\frac{1}{2}$	158	19.09	21.26	2.17	2.939	183.7
7	5 4 $\frac{3}{8}$	140	19.05	21.06	2.01	2.722	170.1
8	5 3 $\frac{3}{8}$	132	19.01	20.86	1.85	2.505	156.6
9	5 4 $\frac{1}{2}$	121	18.97	20.76	1.79	2.424	151.5
10	5 3 $\frac{1}{4}$	146	18.93	20.66	1.73	2.343	146.4

One of the reasons, Mr. Robertson says, that induced him to make these experiments, was a desire of knowing what quantity of fir or oak-timber would be sufficient to keep a man afloat in river or sea-water, thinking that most men were specifically heavier than river or common fresh water; but the contrary appears from the trials above recited: for, excepting the first and last, every man was lighter than his equal bulk of fresh water, and much more so than his equal bulk of sea-water: consequently, if persons who fall into water had presence of mind enough to avoid the fright usual on such accidents, many might be preserved from drowning; and a piece of wood, not larger than an oar, would buoy a man partly above water as long as he had spirits to keep his hold. Phil. Trans. vol. 1. art. 5.

SPECIFIC Gravity of Metals. See the several metals.

SPECIFIC Heat. See **HEAT**.

SPECIFIC Names, in *Natural History*, are those epithets composed each of one or more terms, and placed after the general name, in the denomination of any species of plant, animal, or mineral, expressing those characters by which it differs from all the other species of that genus.

The more accurate of the modern naturalists have, in their several provinces, set about the reformation of the specific names of things. They first observe, that many of the specific names of the ancients no way answered the intent of their formation, but expressed the more trivial distinctions, or accidents, while they omitted the realities, and more essential grounds of distinction. On this foundation the critical writers of our times distinguish the old specific names into the genuine or true, and the spurious or false ones.

The genuine names are those which express those characters,

ters, by means of which the thing becomes a different species; these are invariable, and by these names the thing is, in some sort, described. The false ones are those specific names which do not, and cannot distinguish the species called by them from the others of the same genus, which may as well belong to some other species as to that, and which therefore are of no use to the student. The true formation of these names is on the real characters of the body to be named; but instead of this, these false ones are often formed from accidental or variable distinctions.

SPECIFIC Waters. See WATER.

SPECIFICATION, a term expressing the engineer's statement of the particulars of width, depth, slopes, &c. which a certain length of canal is to have, when the excavation is to be made by contract.

SPECIFICATION is likewise a term used in obtaining patents. See PATENT.

SPECILLUM, a probe, one of the most common instruments of surgery. See *Surgical Plates*.

SPECIOUS ARITHMETIC. See ARITHMETIC.

SPECKHAVEN, in *Geography*, a harbour on the W. coast of West Greenland. N. lat. 64°. W. long. 49° 40'.

SPECKLED BEANS, in *Agriculture*, a term applied to some sorts of the kidney-bean, which are occasionally cultivated in the field, in some districts. The principal varieties which are grown and cultivated in this way in some parts of the county of Kent, are the black speckled and the red speckled; but many others may be employed for the same purpose.

The tillage preparation of the land for field-crops of this sort is the same as that which is made use of for the growth of the common pea and bean; and the manure, which is commonly ploughed in before the seed is put into the ground, is of the more rotten dung kind. See PEAS and BEANS.

The time of planting crops of this nature in the field is in the early part of the spring, as from about the eighth to the twentieth of May, as when it is done earlier, the crops are in danger of being injured, or wholly destroyed, by the occurrence of a frosty morning, which is then liable to take place.

In setting, the seed-beans are dropped by the hand into holes, or small furrows or drills made for the purpose in the land, in the quantity of from five to ten gallons to the acre, in proportion to the size of the sort which is employed; the smaller the sort of bean, the less the quantity which is necessary.

The crops are repeatedly hoed while growing, so as to be kept perfectly clean and free from weeds of all kinds; and in their more early growth the fine mould is a little drawn up to the rows, in order to promote the advancing of the young plants.

The harrowing of the crops is by pulling up the plants by the roots, as the beans become ripe, during the beginning of the autumnal season. The more early sorts are commonly ready and fit to be pulled about the end of August; but the late ones are often not ripe and ready for pulling until the month of October. Those which ripen so late in the season, and are in danger of being injured by wet weather, are frequently tied up in small bunches, and hung upon poles to finish their ripening, and, when thoroughly dry, are threshed out and sent to market, as they seldom keep well.

These sorts of bean-crops are much cultivated and attended to about the town of Sandwich, and in the Isle of Thanet, in the same county, as well, perhaps, as in some other southern parts of the island, for the purpose of sup-

plying the London feedsmen with these kinds of beans. See PHASEOLUS.

This is a profitable sort of culture in some cases and seasons, but liable to much uncertainty.

SPECTABLES, among the Romans, a title of honour given to the second rank, or degree of nobility, under the Roman emperors, being unknown in the time of the republic. There were two other degrees; the first had the title of *illustres*, and the third that of *clarissimi*.

SPECTACLE, **SPECTACULUM**, *Show*; some extraordinary object, which draws the view and attention; and is not beheld without some emotion or passion of the mind.

The term is chiefly used, by the ancients, for theatrical and amphitheatrical performances; for comedies, combats of gladiators, and of beasts; and even for solemn processions, as those of the Circus, &c.

The people of Rome were extremely fond of spectacles; and the Roman historians observe, that there was no surer way of gaining their affections, and making parties to introduce tyranny and oppression, than by the use of spectacles.

SPECTACLES, an optic machine, consisting of two lenses set in a frame, and applied on the nose, to assist in defects of the organ of sight.

It is well known, that parallel rays, or such rays as proceed from a very distant luminous point, will be collected, by the refractions of all the humours through which they must pass in the eye, to a focus on the retina, which is the true place of the image. But at the same time it is evident, that if that be the focal distance for parallel rays, it cannot be the focal distance for diverging rays; or, in other words, when the objects are situated at a few feet distance from the eye, their true images must be formed farther back; consequently their images upon the retina must be imperfect, unless the retina be situated farther back by an elongation of the axis of the eye, or the focal distance be shortened by the alteration of some other part. But since we may perceive either distant or near objects distinctly, it is evident that some such alteration does actually and necessarily take place. This is called the adjustment, or accommodation of the eye for distinct vision; but the difficulty is to determine how this adjustment is effected.

By some persons it has been attributed to a change in the length of the eye, and by others to a change of curvature in the cornea; but some very recent experiments render those alterations unlikely, at least to the full amount of what may be required. Other ingenious persons have attributed the alteration to a change either of the shape of the crystalline lens, or of its situation, or of both; and this opinion seems upon the whole to be nearer the truth.

That the eye cannot see both near and remote objects distinctly at the same time, may be easily proved. Let a tree, a house, or some other object, be upwards of fifty feet from you; shut one eye, and whilst you are looking with a single eye at the tree, &c. hold a pin, a pencil, or some other object, in the same direction, at about a foot distance from the eye; and it will be found, that whilst you see the pin distinctly, the tree will appear indistinct; but if you adjust your eye so as to see the tree distinctly, then the pin will appear indistinct.

The eyes of some persons are more capable of adjustment than those of others. In old persons the humours grow thicker, and the parts less pliable; hence their eyes are less capable of adjustment than those of young persons.

The eyes of some persons can be adjusted for distant objects better than for near objects, and *vice versa*. When the

SPECTACLES.

the eye is defective, and by its size or other conformation, parallel rays form their foci before they arrive at the retina, then the person can see very near objects only. Such persons are said to be near-sighted, or they are called *myopes*. When the eye is flatter than ordinary, then the foci of rays from pretty near objects are formed beyond the retina. Persons with such eyes are called *presbyta*; they can adjust their eyes for objects beyond a certain distance only. The latter is generally the case with old persons; but the eyes of old persons sometimes are incapable of adjustment both for very near and for very distant objects. This comes from a rigidity or want of pliability in the parts. Those defects are frequently brought on or increased by habit, as by the constant custom of viewing objects either from too near or from too great a distance; as also by the use of improper glasses.

Those imperfections may in a great measure be remedied by the use of proper glasses or spectacles; for since, in near-sighted persons, the rays of light converge to a focus too soon, *viz.* before they come to the retina, concave lenses, which diminish the convergency, must remove the imperfection. And for those who can see distant objects only with tolerable distinctness, *viz.* in whose eyes the rays do not converge soon enough, convex lenses, which increase the convergency, must remove the imperfection.

When the defect comes from rigidity, as in some old persons, then those persons require concave glasses for viewing distant objects, and convex glasses for viewing near objects; for their eyes want both adjustments.

The capability of adjustment is greater or less in different eyes, and it is frequently different in the two eyes of the very same person; but in all eyes there is a limit, within which vision is not distinct. This is called the *limit of distinct vision*; and with some persons it is as short as one inch, whilst in others it exceeds twenty inches; but in common it will be found to lie between six and ten inches.

In Spain, and at Venice especially, spectacles have been used with a different view from either of those above stated; all the people of note and fashion there have them continually on their noses: a folly, that has its source in the natural pride of those people, who value themselves on a profound wisdom; and affect to stare very near at every thing; as if their eyes were weakened, and worn out with excess of attention. Vign. de Mary.

F. Cherubin, a Capuchin, describes a kind of spectacle telescopes, for the viewing of remote objects with both eyes; hence called *binoculi*; though F. Rheita had mentioned the same before him, in his "Oculus Enoch et Eliæ." See BINOCLE.

The same author invented a kind of spectacles, with three or four glasses, which performed extraordinarily.

Spectacles were certainly unknown to the ancients. Francisco Redi, in a very learned treatise on spectacles, will have them to have been invented in the 13th century, between the years 1280 and 1311, (probably about the year 1299 or 1300,) and adds, that Alexander de Spina, a monk of the order of Predicants of St. Catharine, at Pisa, first communicated the secret, which was of his own invention; upon learning that another person had it as well as himself. This history is written in the chronicles of that convent.

The same author tells us, that in an old manuscript still preserved in his library, composed in 1299, spectacles are mentioned as a thing invented about that time: and that a famous Jacobin, one Jourdon de Rivalto, in a treatise composed in 1305, says expressly, that it was not yet twenty years since the invention of spectacles. He likewise quotes

Bernard Gordon in his "Lilium Medicinæ," written the same year, where he speaks of a collyrium, good to enable an old man to read without spectacles.

Mulchenbroeck, Introd. vol. ii. p. 786, observes, that it is inscribed on the tomb of Salvinus Armatus, a nobleman of Florence, who died in 1317, that he was the inventor of spectacles.

Du-Cange, however, carries the invention of spectacles farther back; assuring us, that there is a Greek poem in manuscript in the late French king's library, which shews, that spectacles were in use in the year 1150; nevertheless, the Dictionary of the Academy della Crusca, under the word *occhiale*, inclines to Redi's side; and quotes a passage from Jourdon's Sermons, which says that spectacles had not been twenty years in use: and Salvati has observed, that those sermons were composed between the years 1330 and 1336.

It is probable that the first hint of the construction and use of spectacles was derived from the writings either of Alhazen, who lived in the 12th century, or of our own countryman Roger Bacon, who was born in 1214, and died in 1292 or 1294. The following remarkable passage occurs in Bacon's "Opus Majus," by Jebb, p. 352. "Si vero homo aspiciat literas et alias res minutas per medium crystalli vel vitri, vel alterius perspicui suppositi literis, et sit portio minor spheræ, cujus convexitas sit versus oculum et oculus sit in aere, longe melius videbit literas, et apparebunt ei majores.—Et ideo hoc instrumentum est utile senibus et habentibus oculos debiles: nam literam quantumcunque parvam possunt videre in sufficienti magnitudine." Hence, and from other passages in his writings much to the same purpose, Molyneux, Plott, and others, have attributed to him the invention of reading-glasses.

Dr. Smith, indeed, observing that there are some mistakes in his reasoning on this subject, has disputed his claim. See Molyneux's Dioptrics, p. 256. Smith's Optics, Rem. 86—89.

The essential and extensive use of spectacles, which affords comfort to so great a number of individuals, who would otherwise be a burden to themselves and to society, is an instance of the great usefulness of the science of optics.

No pains have been spared to render spectacles as perfect as possible, and a variety of contrivances have been from time to time offered to the public. Spectacles have been made with two lenses for each eye; also the lenses have been made plano-convex, or plano-concave, or of other shapes; but, upon the whole, single lenses, either double concave, or double convex, of clear glass, well polished and regularly formed, are the best.

When the eyes of persons first begin to be affected by age, the opticians furnish them with spectacle lenses, of about forty inches focus, which glasses are therefore called number 1st, or glasses of the first sight; *viz.* for the sight when it first begins to be impaired by age. But there is considerable difference between the focal distances of spectacles. N^o 1, made by different opticians. When the focal length is about sixteen inches, the lenses are called N^o 2. About twelve inches are the focal length of N^o 3. Ten inches are what they call N^o 4. Nine inches are those of N^o 5. Eight inches give the focal length of N^o 6. Seven inches are the focal length of N^o 7. Six inches are the focal length of N^o 8. And sometimes they make spectacles of a focus shorter still. Concave spectacles are also named by similar numbers.

In choosing spectacles, actual trial is the best guide; but care must be had to use spectacles that do not magnify
more

more than is just sufficient either for reading, or for other necessary purposes.

When a variety of spectacles cannot actually be tried, the defect of the sight may be expressed by mentioning the distance from which the person can read, or other peculiarities, from which the necessary glasses may be determined pretty nearly. For an account of the instrument for measuring the exact limits of distinct vision, invented by Dr. Porterfield, and improved by Dr. T. Young, see OPTOMETER.

Huygens conceived, that the glasses of spectacles, instead of being equally curved on both sides, should have the curvatures of their opposite surfaces in the proportion of 6 to 1, and the most convex side turned towards the object, because he had demonstrated that such a form was best suited to the object-glasses of telescopes, as having less aberration than any other form of lens.

Dr. Wollaston observes, that although it may be true that such a form of glass was best calculated for the object-glass of a telescope, previously to the celebrated discovery of the achromatic object-glass by the late Mr. Dollond, yet whatever advantages might at any time be expected from the telescopic object-glass so shaped, these were not to be obtained by a similar construction in spectacles, as may easily be seen by considering the different uses of the respective instruments.

In a telescope, in the first place, our view is necessarily confined to a very small distance on each side of the axis; and, secondly, every part of the object-glass contributes to the distinctness of any object viewed.

It is under these circumstances alone, that the proportion of the curvatures above-mentioned might be proper for a single object-glass, as being capable of collecting into the same focus the rays that fall on every part of it parallel to the axis. But by spectacles, on the contrary, objects are to be viewed, if possible, in every direction in which they might be seen by the naked eye, which is often removed from the centres of the glasses; consequently, a construction that is calculated to represent correctly central objects alone cannot be the most advantageous.

In spectacles also the portion of the glass employed at once is scarcely larger than the pupil of the eye; so that any endeavour to procure the concurrence of all parts of a glass in any one effect is evidently superfluous, and may also be shewn to be prejudicial.

Mr. B. Martin, so well known by his numerous writings upon philosophical and mathematical subjects, made spectacles sixty years ago, which he called visual glasses, and in which the two glasses were not situated in the same plane, or with their axes parallel to each other, but were placed inclined to each other, in the same angle as the pencils of rays must proceed from the objects which are viewed, and come to the two eyes. Respecting the common glasses, this writer observes, in his treatise upon spectacles, that he considered the two glasses of a common pair of spectacles, when placed both in the same plane, and with their axes parallel to each other, as being most adapted to view objects at a very great distance, where we can see no objects with them at all; for, when we use spectacles, the axes of both eyes are always turned to the object which we view, and meet in a point in it, as in reading, writing, working with a needle, &c.; consequently the axes of the eyes, and of the glasses, are so far from coinciding, that they make a considerable angle with each other, by which means the eye is deprived of the principal pencil of rays, *viz.* those rays which belong to the axes of each of the glasses, and which will

make the most perfect part of the image on the retina of the eye, and which rays alone can produce perfect vision. Those rays alone can enter the eye from the object we look at, which come on one side of the glass, or obliquely to its axis, and are therefore regularly refracted to the eye, so as to make the vision in proportion imperfect.

As the action of light upon the eye tends gradually to weaken it, no more of such an active principle should be admitted into so delicate and fine a structure as that of the eye, than what is quite necessary to illuminate the object, and make it sufficiently visible. But the common size of spectacle-glasses pours in upon the eye-balls three times as much as is necessary for this purpose, and, therefore, is very prejudicial to the eyes in that respect, for in time it makes them weak and watery. Further, it is well known that only a particular quantity of light is proper for perfect and distinct vision; and that a greater or less degree of it always impairs and confuses the image, and consequently the vision of the object. For this purpose, in microscopes, telescopes, and other optical instruments, provisions are made to regulate the quantity of light by proper apertures and diaphragms; but in spectacles, where the quantity of light should be in the highest degree regulated and adjusted, no provision at all has been made, but the tender system of the eye has been left defenceless from the superfluous and injurious particles of light.

In common spectacles, only those rays of light which fall near the axis of the glasses, can be regularly refracted to the eye, and consequently only such can make the image, or vision of the object, in any degree perfect: and, therefore, considering the unreasonable area or diameter of the glasses of common spectacles, there must necessarily be a great quantity of light that will not only annoy the image by suffusion, but greatly affect the eye, and render the image imperfect by an irregular refraction from all the extreme parts of the glass.

The lenses of Mr. Martin's spectacles were so fixed in their frame, that the axes of the two glasses were inclined to each other, and met in one point, situated at the same distance from the glasses as the focus of each glass respectively; or, in other words, the foci of the two glasses were brought into one common point: whereas in the common spectacles, the axes of the two glasses being parallel, the two foci are at the same distance apart as the centres of the glasses are. Mr. Martin also recommended opticians to make the glasses smaller; an alteration which was attended with considerable advantages: for, before his time, the lenses were frequently made an inch and a half in diameter.

Dr. Franklin used a pair of double or bisected spectacles, which he thus describes in a letter to one of his friends, "The same convexity of glass, through which a man sees clearest and best at the distance proper for reading, is not the best for greater distances. I, therefore, had formerly two pairs of spectacles, which shifted occasionally; as in travelling I sometimes read, and often want to regard the prospects. Finding this change troublesome, and not always sufficiently ready, I had the glasses cut out, and half of each kind associated in the same circle; the least convex, for viewing distant objects, in the upper half of the circle; and the most convex, proper for reading, in the lower half of the frame. By this means, as I wear my spectacles constantly, I have only to move my eyes up or down, as I want to see distinctly far or near; the proper glasses being always ready. Although I cannot distinguish a letter, even of large print, by the naked eye, with the assistance of this invention, my eyes are as useful to me as ever they were;

SPECTACLES.

and if all the other defects and infirmities of old age could be as easily and cheaply remedied, it would be worth while to live a good deal longer."

Mr. John Richardson, an optician of London, obtained a patent in 1797 for an improvement in spectacles, which consists in applying extra glasses before the common single lenses, and fitted with joints, so that the extra glasses can at pleasure be turned up out of the way, either on one side, or upwards. The advantage of this plan is stated to be, that it precludes the necessity of two pairs of spectacles for different views, but that any two different powers of sight may be instantly obtained: for instance, the spectacles may be fitted with such lenses as are most proper to enable the wearer to see a prospect in walking or riding; but by turning down the extra lenses, the spectacles will magnify in a greater degree, and be proper for reading or writing; and by the same means, coloured glasses may be applied, to be occasionally turned down over the lenses of the spectacles, to walk in the sun-shine.

Mr. John Isaac Hawkins some years ago introduced a new kind of spectacles, provided with extra arms or joints, which pass upwards over the temples, in addition to the usual jointed arms which hold the spectacles, by passing horizontally round the head. By these additional arms the spectacles are borne altogether from the head, without resting upon the nose, which occasions an unpleasant sensation to those who first begin to use spectacles, although it wears off in a few days; but the advantage of Mr. Hawkins's plan is, that the glasses, without occasioning any pressure on the temples, can be placed at any distance from the eye, and inclined in any direction, as is found most convenient for the view.

Dr. Hyde Wollaston's periscopic spectacles are now much in use, and are so called from the facility which they afford the wearer of looking round at various objects. This invention, for which he obtained a patent in 1804, is intended to obviate that defect of the common spectacle-glasses, which we have before mentioned, *viz.* that no objects appear distinct through them, except such as are seen through the centre of the glasses, or nearly so, and that the vision is indistinct, in proportion as the part of the glass through which the rays pass is farther from the centre: this is most particularly observable in glasses of short focal distance, and considerable magnifying power. It is on this account that opticians have lately made and recommended spectacle-glasses of less diameter than those formerly in use, thinking that the extreme parts of the field of vision, which from indistinctness were of little use, might be spared without much inconvenience. But this alteration in the size of the glasses can scarcely be called an improvement, since for one defect it only substituted another scarcely less objectionable.

Dr. Wollaston, having considered that the portion of any glass employed in any one position of the eye is but small, perceived, that by making the substance of a glass curved, in the manner of a hollow globe, each portion of it might be situated nearly at right angles to the direction of the sight, and would thereby render lateral objects distinct, without impairing the distinctness at the centre.

To illustrate this; supposing the eye to be placed in the centre of any hollow globe of glass, it is plain, that objects would then be seen perpendicularly through its surface in every direction: consequently, the more nearly any spectacle-glass can be made to surround the eye, in the manner of a globular surface, the more nearly will every part of it be at right angles to the line of sight, the more uniform will be the power of its different parts, and the more com-

pletely will the indistinctness of lateral objects be avoided. It is evident, that no other rays than those which pass through the centre of a lens can be at right angles to both surfaces; but it is equally clear, that when any small oblique pencil of rays makes equal angles with the two surfaces of a thin lens, its inclination to each surface will be so small, that its focal length will not sensibly differ from that of a central pencil. Upon this principle Dr. Wollaston's spectacle-glasses are made, of a form not heretofore used for that purpose; the outer surface of each glass, or that which is farthest from the eye, being spherically convex, and the inner surface of the same glass, or that which is nearest the eye, spherically concave. A glass of this sort, adapted for a short-sighted person, will have the interior and concave surface of each glass more curved than the exterior and convex surface of the same glass, by which the rays of light passing through the same are diverged, and the degree of curvature of the interior and concave surface is to be increased in proportion as the person who is to use the glasses is more short-sighted. On the contrary, for long-sighted persons, the form of each glass must be such as to have the exterior and convex surface thereof more curved than the interior and concave surface of the same glass, by which means the rays of light passing through the same are converged; and the degree of curvature of the exterior and convex surface of the glass is to be increased in proportion as the person to use the glasses is more long-sighted.

With a view of obtaining the same effects as Dr. Wollaston's periscopic spectacles, a new species of glasses have been lately introduced at Paris, made by Chambiant, optician, Rue Bassé, Porte St. Denis; they are called *conservees*: these glasses are ground to cylindrical surfaces, instead of the spherical surfaces which have hitherto been employed for spectacles and lenses of all kinds: the opposite surfaces of each glass are segments of two different cylinders, inclined to each other at right angles; that is, the axes of the two cylinders are situated in parallel planes, but in direction they lie at right angles to each other, and in consequence, the direction in which one surface of such a glass is curved, is at right angles to the direction in which the other side is curved. On making trial of a pair of these glasses, we found them very perfect in the field of view, presenting a very distinct vision of objects viewed through the outer parts of the glass, as well as those viewed through its central parts: and the magnifying power of the whole field as nearly equal as the eye could judge.

The inventor has obtained a patent in France for this invention, and makes spectacles of all degrees of magnifying power. He proposes to apply similar lenses to telescopes, microscopes, and other optical instruments, but we have not had an opportunity of examining any of them.

Spectacles are made in great varieties of forms, and ornamented according to fashion, or to the fancy of the wearer. The frames are made of all kinds of materials, such as gold, silver, steel, pearl, tortoise-shell, ivory, bone, and wood. The lenses are usually made of glass, but the better sorts are made of natural crystal, and are known by the name of pebble-spectacles, but in reality most of the spectacles sold under that name are made of a hard sort of glass.

It is observed by Mr. Ware (Phil. Trans. for 1813, part 1.) that short-sightedness usually comes on between the ages of ten and eighteen. This defect of sight, as soon as it is accidentally discovered, is little regarded by persons in the inferior stations of society, and no means are used for correcting it; hence by increased exertions that are made for distinguishing distant objects, the imperfection is not unfre-

quently overcome. But when persons in the higher ranks of life discover that their discernment of distant objects is less quick or less correct than that of others, however slight the difference may be, such persons, influenced perhaps by fashion more than by necessity, recur immediately to the use of a concave glass; and thus their eyes become so fixed in the state requiring its assistance, that the recovery of distant vision is rendered afterwards extremely difficult, if not quite impossible. The number of persons who actually need this assistance, is comparatively very inconsiderable; and therefore it should more generally be avoided. The misfortune resulting from the use of concave glasses is this, that the near-sightedness is not only fixed by it, but from a habit of inquiry with regard to the extreme perfection of vision, frequent changes are made for glasses that are more and more concave, until at length the near-sightedness becomes so considerable, as to be rendered seriously inconvenient and afflicting. It ought to be remembered, that, for common purposes, every near-sighted eye can see with nearly equal accuracy through two glasses, one of which is one number deeper than the other; and though the sight be in a slight degree more assisted by the deepest of these than by the other, yet on its being first used, the deepest number always occasions an uneasy sensation, as if the eye were strained. If, therefore, the glass that is most concave be at first employed, the eye, in a little time, will be accommodated to it, and then a glass one number deeper may be used with similar advantage to the sight; and if the wish for enjoying the most perfect vision be indulged, this glass may soon be changed for one that is a number still deeper, and so in succession, until at length it will be difficult to obtain a glass sufficiently concave to afford the assistance which the eye requires. Mr. Ware observes, that most of the near-sighted persons whom he has known, have had the right eye more near-sighted than the left; and he thinks it not improbable, that this difference between the two eyes has been occasioned by the habit of using a single concave hand-glass; which, being commonly applied to the right eye, contributes to render this eye more near-sighted than the other. In some cases children have manifested near-sightedness almost as soon as they begin to take notice of surrounding objects; but this, which is occasioned by some degree of opacity in the transparent parts of the eye, is very different from that state of the eye to which the term myopic, or near-sightedness, is usually applied; and by which is simply meant too great a convexity either in the cornea or in the crystalline, in proportion to the distance of these parts from the retina. So far from discouraging the use of spectacles in such cases, it is necessary to recur to them, as without them children could not prosecute their learning with ease or convenience. Extreme near-sightedness is sometimes occasioned by an evident change in the spherical figure of the cornea, and its assumption of a conical shape. This morbid state of the cornea admits of no amendment by any glass. The cornea, in most cases of this kind, is preternaturally thin; and it is not unfrequently accompanied with symptoms of general debility, under which last circumstance, chalybeate medicines, and bracing applications to the eye, have afforded considerable benefit. Near-sightedness, our author says, is seldom alike in the two eyes, and he has observed a few cases, in which one eye of the same person has had a near, and the other a distant sight. Dr. Porterfield has suggested, that the pupils of near-sighted persons are more dilated than those of others; but this does not accord with Mr. Ware's observations in such cases. This ingenious writer, whose remarks on all circumstances relating to the eye merit peculiar attention, observes, that near-sightedness has no de-

pendence on the greater or smaller degree of convexity possessed by the cornea, when this circumstance is considered alone; since the length of the axis of the eye from the cornea to the retina, and the greater or smaller degree of convexity in the crystalline humour, must be also regarded before the distance of accurate vision can be determined. It is also no less evident, that near-sightedness is not necessarily occasioned by a morbid protrusion of the whole eye; since some persons are born with eyes of this description, and others acquire the peculiarity, when further advanced in life, in consequence of a morbid accumulation of *aque* at the bottom of the orbit, without either of them being more near-sighted than those who are free from this imperfection. It is a fact often noticed, that old persons, who have been long accustomed to use convex glasses of considerable power, have recovered their former sight, even at the advanced age of 80 or 90 years, and have then had no further need of them. This amendment is ascribed by Dr. Porterfield to a decay of *aque* at the bottom of the orbit; but Mr. Ware attributes this remarkable revolution in the sight of old persons to an absorption of part of the vitreous humours; in consequence of which, the sides of the sclerotica are pressed inward, and the axis of the eye, by this lateral pressure, is proportionably lengthened. This kind of alteration is also sufficient to explain the reason, why such aged persons retain the power of distinguishing objects at a distance, at the same time that they recover the faculty of seeing those that are near; since the lengthened axis of the eye leaves the power by which it is adjusted to see at different distances, precisely in the same state in which it was before the lengthening of the axis took place. The faculty, says Dr. T. Young, of seeing at different distances, is produced by a power in the crystalline humours to become more or less convex, according as the object is more or less distant from the eye.

Although old persons lose the power of distinguishing correctly near objects, and require for this purpose the aid of convex glasses, they usually retain the sight of those that are distant as well as when they were young. Instances, however, occur of persons advanced in life, who require the aid of convex glasses to enable them to see near, as well as distant objects. From the case of persons who have had the crystalline humour removed, Mr. Ware infers, that this humour is indispensably necessary to enable the eye to see at different distances. Such persons also have less power to ascertain the distance of an object when they look through a convex glass than when they view it without this assistance; and accordingly such persons seldom make use of glasses when they are walking; and the inconvenience of glasses is particularly experienced when they descend a flight of steps, or pass over uneven ground. Our author observes, that near-sighted persons do not appear to possess the same extent of vision that is enjoyed by those who have a distant sight, and he verifies the observation by a statement of his own case, whose range of distinct vision did not extend further than an inch and a quarter in either eye, and within these distances he always held a book when he read. He recommends the following rule for determining the concavity of a glass that is best adapted for near-sighted persons, to those who are unable, from distance or any other cause, to suit themselves at the shop of an expert optician. The rule is this: multiply the distance at which the person reads with ease, (which in our author's case, with his left or best eye, was five inches,) by that at which he wishes to read, which may be stated at 12 inches; divide the product, 60, by 7, the difference between the two, and it leaves nearly 9 inches for the focus of the concave glass that shall produce the desired effect. This glass answers to that sold under the name of N^o 6; and this

is a double concave glass, ground on a tool of 8 inches radius on one side, and 11 inches on the other, the mean between which is very nearly 9 inches. From the whole statement of our author, he infers, 1. That near-sightedness is rarely observed in infants, or even in children under ten years of age. It affects the higher classes of society more than the lower; and few instances occur, if any, in which, if the use of concave glasses has been adopted, increasing years have either removed or lessened this imperfection. 2. Although the usual effect of time on perfect eyes is that of inducing a necessity to make use of concave glasses, in order to see near objects distinctly, yet sometimes, even after the age of 50, and after convex glasses have been used many years for this purpose, the eyes have not only ceased to derive benefit from them, when looking at near objects, but they have required concave glasses to enable them to distinguish, with precision, objects at a distance. 3. Although the cause of this change be not always known, yet sometimes it has been induced by the use of evacuating remedies, particularly of leeches applied to the temples; and sometimes by looking through a microscope, for a considerable length of time, on several successive days. 4. Instances are not uncommon, in which persons far advanced in life, (*viz.* between 80 and 90,) whose eyes have been accustomed for a long time to the use of deeply convex glasses, when they have read or written, have ceased to derive benefit from these glasses, and they have become able, without any assistance, to see both near and distant objects almost as well as when they were young. This change is probably owing to an absorption of part of the vitreous humour, by which the axis is lengthened; and thus its length, from the cornea to the retina, is brought into the same proportion to the flattened state of the cornea, or crystalline, or both, which it had to these parts before the alteration took place.

SPECTATOR, a person present at a spectacle.

Among the Romans, spectators, *spectatores*, more particularly denoted a kind of gladiators, who had received their discharge; and were frequently hired to be present as spectators at the combats of gladiators, &c. with which the people were entertained. See **RUDIANIUS**.

SPECTER, in *Conchology*, a name given by the French naturalists to a species of *voluta*, on which there are several reddish broad bands, composed of loose and irregular figures; the ground colour is a fine white. They are called by Latin writers *concha spectrorum*.

SPECTRORUM CANDELA, in *Natural History*, a name by which some have called the belemnites.

SPECTRUM, OCULAR, in *Optics*, a name given by Dr. Darwin (*Phil. Trans.* for 1786) to an image, resembling in form the object to which the observer was attending, and which continues for some time to be visible, on closing his eyes or covering them, after having been long and attentively looking at a bright object, such, *e. g.* as the setting sun. These ocular spectra, he says, are of four kinds; *viz.* 1. Such as are owing to a less sensibility of a defined part of the retina, or "spectra from defect of sensibility." 2. Such as are owing to a greater sensibility of a defined part of the retina, or "spectra from excess of sensibility." 3. Such as resemble their object in colour as well as in form, which may be termed "direct ocular spectra." 4. Such as are of a colour contrary to that of their object, which may be termed "reverse ocular spectra." The author, from experiments which he has detailed, concludes, that the retina is in an active, not in a passive state, during the existence of these ocular spectra; and hence he infers, that all vision is owing to the activity of this organ. In the first case, the retina is not so easily excited into action by less irritation,

after having been lately subjected to greater. In the second, the retina is more easily excited into action by greater irritation, after having been lately subjected to less. In the third, a quantity of stimulus greater than natural excites the retina into spasmodic action, which ceases in a few seconds: and a quantity of stimulus somewhat greater than the last excites the retina into spasmodic action, which ceases and recurs alternately. In the fourth case, the retina, after having been excited into action by a stimulus somewhat greater than the last mentioned, falls into opposite spasmodic action. The retina, after having been excited into action by a stimulus greater than the last mentioned, falls into various successive spasmodic actions. With a greater stimulus, the retina falls into a fixed spasmodic action, which continues for some days; and a quantity of stimulus still greater, induces a temporary paralysis of the organ of vision. For the illustration of the cases, with miscellaneous remarks, we must refer to the author's paper, *ubi supra*.

SPECULA, among the Romans, were places whence a good view might be had of what was doing at a distance. The word is particularly used to signify watch-towers and beacons.

SPECULARES, in *Natural History*, the name of a genus of fossils of the class of the talcs.

The word is derived from the Latin *speculum*, a looking-glass; the bodies of this kind being naturally of bright, glossy, and polished surfaces, and in the thicker masses not transparent, but reflecting the images of things.

The speculars are talcs, composed of visibly separate plates of extreme thinness, and each fissile again into a number of others yet finer.

The bodies of this genus are the common Muscovy talc; the *specularis lucida fusca*, or brown talc, a species little inferior to the former in beauty, and found in Germany and England; and the *specularis amethystina*, called *talc rouge*, or *red talc*, by the French. This is found in Muscovy and Persia, and no where else, as far as is yet known, and is often imported into France in masses, which are of a beautiful purple: we have of it brought into England, but only in thin flakes, fit for the covering of miniature pictures. In these flakes it has none of the redness natural to it in the lump, but is the finest and most transparent of all the talcs.

Pliny, and other of the ancient writers, as well as several of the moderns, use the term *specularis lapis* for that species of talc commonly known by the name of *islinglass*, or *Muscovy glass*.

This has been a substance in great use among mechanics, from the earliest times of which we have any account. It is found in broad flat masses of ten or twelve inches in breadth, and from half an inch to three inches in thickness; and is composed in these of an almost infinite number of broad and beautifully even plates, or flakes, laid with a perfect regularity on one another, and seldom parting naturally from each other, though by art they may be divided, almost without end, into broad and extremely thin laminæ. These are very flexible and elastic, and make no effervescence with aqua fortis. By the last of these properties they are distinguished from the plated spars which some have confounded with them, and by their elasticity from all other fossil bodies.

It is found in many parts of the world. The island of Cyprus abounds with it. It is very common also in Russia, and has of late been discovered to abound in the Alps, the Apennines, and many of the mountains of Germany. It is imported in large quantities into England, and is used by the lantern-makers instead of horn, in their nicer works; by the painters to cover miniature pictures; and by the microscope

croscope makers to preserve small objects for viewing by glasses. The ancients used it instead of glass in their windows. Hill's Hist. of Fossils, p. 72.

Some take the lapis specularis to have been a species of gypsum, and composed of the acid of vitriol and calcareous earth. It came into use at Rome in the age of Seneca (Ep. 90.), and soon after its introduction, was applied not only to give light to apartments, but to protect fruit-trees from the severity of the weather; and it is recorded, that the emperor Tiberius was enabled, principally by its means, to have cucumbers at his table during almost every month in the year.

Dr. Watson apprehends it is still used in some countries in the place of glass; however, it is well known that it was so used in the time of Agricola, for he mentions (De Nat. Fof. lib. v. p. 257.) two churches in Saxony which were lighted by it. Agricola esteemed it to have been a species of plaster-stone, and in speaking of it he remarks, that though it could bear, without being injured, the heat of summer and the cold of winter, yet the largest masses of it were wasted by the rain. However, it differs from plaster-stone in this property, that it does not, after being calcined and wetted with water, swell and concrete into a hard stony substance. Watson's Chem. Ess. vol. ii. p. 297, &c.

SPECULARIA, among the Romans, a kind of window casements, which were used before glass was introduced for this purpose. They consisted of transparent stones, called *lapides specularis*.

SPECULARIA, the art of preparing and making specula, or mirrors: or the laws of mirrors, their phenomena, causes, &c. called also *catoptrics*.

SPECULARIS LAPIS, in *Natural History*. See **SPECULARES**.

SPECULATION. — *Certainty of Speculation*. See **CERTITUDE**.

SPECULATION Shell, in *Natural History*, a name given by the French writers to a very beautiful species of the voluta, usually called by us the Guinea-shell, from its being brought from that part of the world.

SPECULATIVE Geometry, Mathematics, and Philosophy. See the substantives.

SPECULATIVE Music. By this expression is usually understood scientific music, harmonics, the ratio or proportions of sound; in opposition to *practical music*, which implies music composed or performed.

SPECULUM, in *Catoptrics*, is a metallic reflector made use of in catadioptric telescopes, instead of the object-glasses used in dioptric telescopes.

Newton. — Mr. Newton, afterwards the celebrated Sir Isaac Newton, had discovered that *light consists of rays differently refrangible*, and that consequently no figure, which could be given to a single piece of glass, would make all the transmitted rays concentrate in the focus of that glass used as an object-glass: he relinquished his glass-works, and immediately turned his mind to the consideration of what could be done in the construction of a telescope, where the rays of light were made to concentrate by reflection; having previously discovered and proved, that the angle of reflection of all sorts of rays was equal to the angle of incidence, without the least perceptible dispersion. Under an impression that an instrument, founded on this basis, might be made more perfect than could be made with glasses alone, when used in the usual way, he tried such metallic substances as promised to produce a hard and bright texture, and to admit of a good polish, and in

February, 1672, laid before the Royal Society an account of a telescope of an entire new construction, that gave a distinct image, and magnified or increased the visual angle thirty-eight times. It is somewhat remarkable, though not so much to be wondered at, when we consider the genius of the inventor, that this first attempt detected not only the best materials, but the best mode of fusing and mixing them, if not in the best proportions; and left succeeding instrument-makers little more to do than to vary the proportions, and to exemplify the theory which he pointed out by a succession of nice and skilful manipulations. Copper, tin, and a portion of arsenic, with sometimes a little silver, were then, as they are at this time, the essential ingredients of the compound metal that constituted the best speculum. The ingenious Huygens was no sooner informed of the occasion and success of this project, than he calculated and candidly acknowledged the advantage that a good concave speculum must have over convex glasses in concentrating all the different rays of heterogeneous light. With this first instrument the satellites of Jupiter, as well as the lunc of Venus's disc, were clearly perceived. The second telescope, however, was more perfect, and a page of the Philosophical Transactions could be distinctly read with it at the distance of 100 feet. In this construction, which has obtained the name of the Newtonian construction, there were two specula: one speculum, which was ground to a given radius of curvature, was placed at the end of the tube, which was remote from the object to be viewed, and the other, which was small, was plane, and was fixed in an angle of 45° in the axis of vision, so as to reflect the converging rays to a focus, at the focus of a small eye-glass placed at the side of the tube, not far from its anterior end or aperture where the eye was situated to view the object, that actually lay to the left hand. Cassegrain in the same year communicated to the Royal Society the figure of a reflecting telescope, where a perforation in the large speculum admitted the eye-piece to be placed as in the dioptric telescope, which he thought had several advantages, but he did not detail any processes he had used towards attaining such a construction; in reply to which Sir Isaac informed him, that Mr. Gregory had described a similar construction in his "Optica Promota," in the year 1663, from which reply it should seem, that *reflection* had been considered by Gregory before Sir Isaac constructed his telescope, so that the *Gregorian* construction must be considered as preceding the *Newtonian*, so far as relates to the arrangement of its parts; but we are not to conclude from thence, that the best composition for the speculum was not Sir Isaac Newton's. During the correspondence that Huygens had with our author, on the subject of a metallic speculum, he took occasion to observe, that no doubt the superiority of a parabolic curve for the face of the reflecting metal over a spherical one must be known to him, and Sir Isaac was of opinion that some mechanical device might be found out, to produce the desired curvature, better than any of the *conic sections*; that is, as we suppose, better than any tool formed agreeably to one of the conic sections: and with this view Mr. Stephen Gray, we find, presented a project of forming a grinding tool of a *concatenary* shape to be substituted for the parabola, which, however, did not answer in practice. The project was this; a piece of clay was formed thin, when soft, into an exact circular cake, and laid on a suspended horizontal rim or ring of a smaller diameter, so as to allow the cake to assume the shape of the required curve, which it appeared to do; but on baking this convex cake, it was found to have altered its figure,

and to have become flat at the vertex, so as to be incapable of becoming a proper bed for the bituminous coat that was intended to receive the emery.

In the telescope which Sir Isaac Newton first made, the focal length of the concave speculum was 6' inches, that of the eye-piece, which was a plano-convex lens, being just $\frac{1}{4}$ th; but as the metal was neither perfect, nor very highly polished, he thought that the power ought not to be so highly charged for opaque objects, particularly as the aperture was only $\frac{1}{4}$ d of an inch. Supposing the performance of any instrument to be known and approved, the author proposes the subjoined table to shew what ought to be the apertures, lengths, and powers or charges of other instruments to perform equally well. In the first column the length of the telescope is expressed in feet; which quantity doubled gives the semi-diameter of the sphere on which the concave metal is to be ground; in the second column are the proportions of the apertures for these several lengths; and in the third column are the proportions of the charges or diameter of the spheres, on which the convex superficies of the eye-glasses are to be ground.

Lengths.	Apertures.	Charges.
$\frac{1}{2}$	100	100
1	168	119
2	283	141
3	383	157
4	476	168
5	562	178
6	645	186
8	800	200
10	946	211
12	1084	221
16	1345	238
20	1591	251
24	1824	263

Suppose, for example, that a half-foot or six-inch telescope will magnify distinctly 30 times with one-inch aperture, and that it be required to find the dimensions of an analogous four-foot telescope; then opposite 4, in column 1, we see 476, in column 2; and if 100 at the top of this column be considered 1.00, then 476 will be 4.76 for the corresponding aperture; also 168, in column 3, will be 1.68 for the charge, producing a magnifying power of 1.45 times; for if the telescope of six inches magnify 30 times, the focus of its eye-glass must be $\frac{1}{3}$ th of an inch, and $\frac{1}{3} \div \frac{1}{30} = \frac{1}{10}$ nearly will be the focal length of the eye-glass for 4 feet or 48 inches, and consequently this number divided by $\frac{1}{3}$ will give 145 nearly for its power. "But what the event will really be," says Newton, "we must wait to see determined by experience." And experience, we may add, has shewn, that a four-foot reflector, as now made, with the small speculum also concave, will do much more.

Hadley.—From this time we do not find that much, if any, improvement took place in the manipulation of the metallic speculum, till about the year 1719, when Mr. Hadley succeeded in making two reflecting telescopes of 5 feet 3 inches long; one of which he presented to the Royal Society of London, and described in the *Philosophical Transactions* of March and April, 1723. But though Mr. Pound and himself made good observations on Saturn, Jupiter, and their respective satellites therewith,

nothing is said about the means used in casting, grinding, and polishing either of the specula in question. Dr. Robert Smith, in his "Complete System of Optics," has, however, supplied the omission we have just noticed, and has stated at considerable length how Hadley's method of proceeding was practised successfully by Dr. Bradley and himself at Kew, where, after many trials, they produced their first specimen, of 26 inches focal length, in May, 1724. The different processes were now made known to Hawksbee, Scarlet, and Hearne, mathematical-instrument makers in London, who, from that period, continued to manufacture this instrument for sale, which before had been made only by and for private individuals.

We will give here only a short detail of the processes used by Hadley, Smith, and Bradley, in casting, polishing, and figuring their specula; because the modern improvements in this curious art claim our more particular notice. Having fixed on the radius of curvature, and proposed diameter, of the large speculum, two arcs were struck with a beam-compass on two slips of brass, large enough to receive the curves of the same radius as that of the speculum; and when the metal was filed away, so that one of the curves was convex, and the other concave, they were ground within one another with fine emery, till they exactly fitted each other, and then became gauges for forming the wooden patterns by, which were next made in a lathe, of somewhat larger dimensions than were required for the speculum, that the rough edges of the cast-metal might be reduced, as the case should require. From this wooden pattern another of pewter, containing about one-tenth of regulus of antimony, was cast in the usual way, and turned in the lathe to fit the convex brass gauge, and to exceed the proposed speculum by one-twentieth of an inch in thickness, and double that quantity in diameter. The flasks for receiving the pewter pattern, for casting the speculum by, were of iron, and two inches wider, and one inch deeper, than the pattern, in order that the sand might be every where an inch thick; and the ingates for receiving the fluid metal were so made as to allow four or five streams over the face of the sand, which was obtained at Highgate. This sand was neither much wetted, nor rendered too adhesive by an admixture of clay; and when the liquid metal was poured in, the flasks were suffered to remain exposed to the sun, so as to cool gradually, before the metal was taken out, in order that it might neither warp nor crack. With respect to the composition of the metal, above 150 different mixtures were tried before one was determined on, which was preferred to some of the rest. One of the metals was three parts of copper and one and a quarter of tin, which was hard and white, but found to be porous, especially if great heat was used. Another was six parts of Hamburgh plate brass, cast and milled, with one part of tin only; but the fumes of the calamy stone left scabrous streaks on the surface. A third metal, therefore, composed of two parts of the former of these compositions, and one of the latter, was adopted, as being superior to either; but it was found necessary that the copper and brass should be melted together separately, before the tin was melted and poured in. And much importance was attached to the immediate pouring out of the whole mixture, as soon as it could be well stirred: for after cooling, less heat was necessary to melt the whole mixture, than was sufficient to fuse one of the ingredients alone; and the less heat was used in bringing the mass into a liquid state, the less porous the speculum was found to be, when polished. After the metal thus cast had become cool, it was first ground on a common grinding-stone a little concave, till

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all the sand-holes and inequalities were taken off; and then a smaller grinding-stone, or a piece of one, was shaped so convex as to fit the brass concave pattern, on which the metal was again ground, when fixed upon a block, with a little emery and water, till the gauge fitted it. The diameter of the rough stone was to the diameter of the speculum as 6 to 5. When the strokes in grinding were made in a circular direction, they diminished the edges of the stone; but when made across, they made it flatter, so that it might be made a portion of either a smaller or larger sphere, by the mode of working, and consequently might be made to grind the concave speculum accordingly. But care was taken that as little of the external hard crust was ground away as possible, when the figure was once complete, and the surface even. When the rough grinding was finished, various other tools were used, not only with the speculum, but with each other, to insure an uniformity of shape. A brass concave tool, shaped like the speculum, but of larger diameter, was worked on a marble convex tool, on which were bedded by cement a number of small blue hones, like a pavement; so that the working of the brass concave tool on this pavement made a convex curve over the surface of the pavement, which was thus prepared to smooth the speculum still further, as well as to improve its figure, by varying the mode of applying the grinding strokes. Again, a polishing tool made convex, of glass or fine marble, and brought to its figure by the brass concave tool, was covered with a piece of fine even farcenet, and laced tight behind, on which a solution of pitch in spirits of wine was spread evenly with a varnish brush, till its consistence was uniform, and thick enough to receive a portion of fine putty powder, when another tool, made concave of brass, called a *bruiser*, was used to rub down the gritty matter of the putty occasionally, as well as to grind sometimes the bed of hones, when its figure began to alter too much. During the grinding, a wooden handle was cemented on the central part of the speculum, to move it by. It would be tedious to detail all the variety of precautions, with the succession of circular, spiral, and cross strokes, recommended for giving perfection to the figure and polish of the metal; all which the reader may find in Smith's Optics, from page 301 to page 312, together with the author's mode of examining both the exact length of the focus, and the figure of the curve, by the reflected light of a candle.

In reflecting telescopes of various lengths, a given object will appear equally bright and equally distinct, when their linear apertures, and also their linear amplifications, or magnifying powers, are as the square-square roots of the cubes of their lengths, agreeably to both Sir Isaac Newton and Dr. Smith. For example, suppose that a reflecting telescope, with an aperture of 2.448 inches, have a speculum of two feet focal length, and an eye-glass of $\frac{1}{3}$ inch of an inch focus, where the power will be $\frac{2.448}{\frac{1}{3}} = 102$, and that it be required to have another made of three feet focal length, that shall produce the same brightness and distinctness in the object viewed; first we shall have $2 \times 2 \times 2 = 8$ for the cube, and the square root of $8 = 2.83$, and again the square root of $2.83 = 1.68$; then $3 \times 3 \times 3 = 27$ is the cube of the new focal length, and 5.2 its square root; and again, the square root of 5.2 will be 2.28 ; hence, as $1.68 : 2.28 :: 102 : 138$; therefore 138 will be the magnifying power of the enlarged telescope, 0.261 the focus of its eye-piece, and 3.312 inches its corresponding aperture; for as $1.68 : 2.28 :: 2.448 : 3.312$, &c.; and also $\frac{1}{3} : 0.261 = 0.261$.

The following table, constructed on this proposition, was calculated by Dr. Smith, which we insert, as being in

a form more intelligible to a common workman, than the one we have before inserted from the calculation of Sir Isaac Newton.

Focal Distance of Speculum.	Focal Distance of Eye-Glafs.	Magnifying Power.	Aperture.
Feet.	Inches.		Inches.
$\frac{1}{2}$	0.167	36	0.864
1	0.199	60	1.440
2	0.236	102	2.448
3	0.261	138	3.312
4	0.281	171	4.104
5	0.297	202	4.848
6	0.311	232	5.568
7	0.323	260	6.240
8	0.334	287	6.888
9	0.344	314	7.536
10	0.353	340	8.160
11	0.362	365	8.760
12	0.367	390	9.360
13	0.377	414	9.936
14	0.384	437	10.488
15	0.391	460	11.040
16	0.397	483	11.592
17	0.403	506	12.144
<i>Continued by Edwards.</i>			
18	0.409	528	12.67
19	0.414	550	13.20
20	0.420	571	13.71
21	0.425	593	14.23
22	0.430	614	14.73
23	0.435	635	15.21
24	0.439	656	15.73

This table is adapted for telescopes of the Newtonian construction, in which the figure of the great metal is supposed to be truly spherical; but it is presumed, that when this table supposes the construction to be of the Gregorian kind, the focal length is the sum of the focal lengths of both the specula, or the distance that the rays pass after both reflections, before they come to the eye-glass; and that the large speculum is parabolical.

Short.—We do not find that any optician distinguished himself in the art of making specula for reflecting telescopes, after Dr. Smith's time, till we come to Mr. James Short, whose composition was beautiful, and whose polish, as well as parabolic figure, were excellent; nay, have been considered as standards of perfection for even subsequent opticians to imitate. We have, however, to regret that this consummate workman not only kept his process a secret from the other opticians, but, in order to secure to himself the fame he had acquired of being the first in his line of manufactory, some little time before his death, as we are credibly informed, he employed his founder, Mr. Justice Blackburgh, to destroy all his tools, lest they should fall into some person's hands, who might avail himself of their use; and accordingly they were all melted into a liquid mass: and his long and successful experience has no further benefited posterity, than as it left specimens of workmanship to shew what skilful perseverance could effect.

Short left behind him, however, a table of the apertures, powers,

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powers, and prices, of reflecting telescopes, constructed by him in the Gregorian form; which, not being generally known, we shall subjoin, by way of effacing the blot on his memory.

Numbers.	Focal Length in Inches.	Diameter of Aperture in Inches.	Magnifying Powers.	Price in Guineas.
1	3	1.1	1 power of 18 times.	3
2	4 $\frac{1}{2}$	1.3	1 25.	4
3	7	1.9	1 40.	6
4	9 $\frac{1}{2}$	2.5	2 40, and 60.	8
5 } 6 }	12	3.0	2 55, and 85.	10
	12	3.0	4 35, 55, 85, and 110.	14
7	18	3.8	4 55, 95, 130, and 200.	20
8	24	4.5	4 90, 150, 230, and 300.	35
9	36	6.3	4 100, 200, 300, and 400.	75
10	48	7.6	4 120, 260, 380, and 500.	100
11	72	12.2	4 200, 400, 600, and 800.	300
12	144	18.0	4 300, 600, 900, and 1200.	800

In this table Mr. Short *always* overrated the *highest* power of his telescopes, according to the authority of the Rev. John Edwards, of whom we shall have occasion to speak hereafter; and to this circumstance alone, we are assured by an ingenious and candid optician, it is to be ascribed, that all following opticians have been obliged, by way of satisfying the expectations of their customers, to overrate the highest power of their telescopes, in order to obtain a price adequate to their respective values. Experimental measurements, indeed, soon detect this false representation; and it would be to the credit of opticians, if they would agree to fix a true measure to each power of their telescopes, and to sell them, notwithstanding, at their accustomed prices: for then their purchasers would not experience disappointment.

Short made two or three Gregorian telescopes of 18 inches focus, with 4.5 inches aperture, and power 170; and half a dozen of 24 inches focus, with 6 inches aperture, with the usual magnifying powers; but one of a Cassegrain form, with a convex small speculum, of the same dimensions, intended to have a power of 355, was not distinct, and would bear only a power of 231.

Mudge.—In the year 1777, Mr. John Mudge produced a paper to the Royal Society, which is printed in their 67th volume, entitled “Directions for making the best Composition for the Metals of reflecting Telescopes; together with a Description of the Process of grinding, polishing, and giving the great Speculum the true parabolic Curve.” It will be sufficient for our present purpose, if we shew in what respects Mr. Mudge’s metal differs from that which we have just described, and in what his improvements in casting consist. In the first place, Mr. Mudge attempted to ascertain what metals, and proportions of those, will produce a composition that has the three requisites of extreme hardness, whiteness, and compactness, or exemption from porosity. The first two qualities, after many experiments, he found were united in a mixture of 14 $\frac{1}{2}$ ounces of grain-tin with two pounds of good Swedish copper; but the quality of compactness was not to be acquired from the mixture simply considered: it was produced principally from the manner in which the mixture was made. It had been usual to melt the copper first, and then to add the tin, and to pour the liquid mixture, with the scoria first taken off, into the flasks, to form the speculum in the first melting; but the metal generally turned out to be porous, when polished. Mr. Mudge, on con-

sidering that putty is tin calcined, began to think, that part of the tin melted in a high heat might be converted into putty, and that the pores might arise from this cause; he, therefore, poured out the liquid compound to form an ingot, which would fuse with a lower heat than the copper alone required; and on using this metal a second time, fused with a moderate heat, it was generally, if not always, found compact. Thus melting a second, or even a third time, proved to be a remedy against porosity; and it was afterwards found, that if an ounce of the tin was reserved to be put into the mixture at the final melting, the brilliancy of the metal was thereby increased. If a spoonful of charcoal dust be thrown into the crucible, before the metal be stirred with a wooden spatula, and poured into the moulds, Mr. Mudge says that the metal will be found to have a cleaner surface, than when no such dust is used. For Mr. Mudge’s method of grinding, polishing, and figuring his specula, see our article GRINDING.

Edwards.—In the Nautical Almanac of the year 1787 is printed a memoir, entitled “Directions for making the best Composition for the Metals of reflecting Telescopes, and the Method of casting, grinding, polishing, and giving the great Speculum the true parabolic Figure,” by the Rev. John Edwards, B.A., of Ludlow. These directions having been considered an improvement on Mr. Mudge’s, in several respects, were published first in a pamphlet, which was soon bought up by the trade; but at the request of the composer of the present article, they were reprinted in Nicholson’s Philosophical Journal, vol. iii. 8vo. Series, p. 490, et. seq., in the year 1800; but with the omission of a portion of the appendix.

After what we have already said on this subject under our article GRINDING, as well as in the preceding part of our present article, it will not be necessary to give the whole of Mr. Edwards’s memoir, but to dwell more particularly on those methods of proceeding which are peculiarly his own, and which constitute his acknowledged improvements. The first object that Mr. Edwards had in view was, like that of his predecessors, to ascertain, by a number of trials of various mixtures, made from the metals and semi-metals, what composition is, on the whole, to be preferred: for which purpose he tried silver, platina, iron, copper, brass, lead, and tin, crude antimony, regulus of antimony, martial regulus of antimony, arsenic, bismuth, zinc, and antimony combined with cawk-stone; and in the appendix to his memoir he gave the result of 71 mixtures, which we will here

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transcribe, in order that the same experiments may not be fruitlessly repeated by future mechanicians.

1. Copper and grain-tin, equal parts; very bad, soft, and of a blue colour.
2. Copper with arsenic $\frac{1}{6}$; but little different from the first.
3. Tin 2, copper 1; much worse than the preceding ones.
4. Copper 32, tin 16, arsenic 4, fixed with nitre; black and brittle.
5. Copper 6, tin $1\frac{3}{4}$, arsenic 1; very indifferent.
6. Copper 32, tin 14, arsenic 2; a very good metal.
7. Copper 32, tin $13\frac{1}{2}$, arsenic 1; not quite so good as the sixth.
8. Copper 32, tin $13\frac{1}{2}$, arsenic $1\frac{1}{2}$; a good metal.
9. Copper 32, tin 15, arsenic 2; much better than any of the above.
10. Copper 6, tin 2, arsenic 1; compact, but very yellow when polished.
11. Copper 3, tin $1\frac{1}{4}$; compact, and whiter than the tenth.
12. Copper 32, tin $14\frac{1}{2}$; a pretty good metal, but polishes too yellow.
13. Copper 32, tin 15, arsenic 2, flint-glass in powder 3; very bright, but rotten.
14. Brass 6, tin 1; compact, but too yellow.
15. Two parts of the eleventh composition, and one part of the fourteenth composition; compact, but much too yellow when polished.
16. Brass 5, tin 1; somewhat whiter than the fourteenth.
17. Brass 4, tin 1; a good metal, but rather yellow.
18. Brass 4, tin 1, with arsenic $\frac{1}{10}$; whiter than the seventeenth.
19. Brass 3, tin 1; will not polish well.
20. Brass 2, tin 1; of a sparry nature.
21. Tin 3, brass 1; too soft, being only a kind of hard pewter.
22. Brass and arsenic, equal parts; a dirty white colour.
23. Brass, copper, and arsenic, equal parts; a dingy white.
24. Brass and platina, equal parts; very difficult to fuse and mix well together, is then malleable, and of a dingy white colour, like the twenty-second composition.
25. Copper 32, tin 14, crude antimony 4; black and rotten.
26. Copper 32, tin 14, crude antimony 1; blueish, and rough-grained.
27. Copper 32, tin 15, arsenic 4, bismuth 2; much too rotten.
28. Copper 32, tin 15, arsenic 3, bismuth 1; much too yellow when polished, and appears also porous.
29. Copper 2, zinc 1; a pale malleable metal.
30. Copper and zinc, equal parts; still malleable and rough-grained.
31. Copper 32, tin 15, arsenic 4, zinc 4; a good metal, but does not take a high lustre.
32. The thirty-first composition, fluxed with corrosive sublimate; a compact and hard metal, but rather yellow when polished.
33. Copper 32, tin 16; a most beautiful brilliant composition, but much too brittle and rotten.
34. Copper 32, tin 17; blueish and rough-grained.
35. Copper 32, tin 18; blueish and rough-grained.
36. Brass 2, zinc 1; nearly of a gold colour.
37. Brass and zinc, equal parts; a pale gold colour, and rough-grained.

38. Spelter 4, tin 1; very rotten.
39. Copper and crude antimony, equal parts; of a sparry nature.
40. Copper 32, tin 15, arsenic $\frac{1}{4}$ th of the whole; a very beautiful and brilliant metal, but tarnishes when exposed for some time to the air.
41. Silver and bismuth, equal parts; a yellowish-white metal, and not much harder than silver itself.
42. Silver and tin, equal parts; a white metal, almost like silver itself, and much too soft for specula.
43. Silver, tin, and bismuth, equal parts; a dingy white colour, but much harder than the two preceding compositions.
44. Copper 32, tin 15, silver 1; a beautiful compact metal, but polishes rather too yellow.
45. Copper 32, tin 15, silver 2; not so white as the preceding.
46. Copper 32, tin 16, brass 4, arsenic 2; rather too much tin, as the composition was of a blueish complexion, and rough-grained.
47. Copper 32, tin 15, brass 1, silver 1, arsenic 1; a most excellent metal, being by much the whitest, hardest, and the most reflective I have ever yet met with.
48. Common bell-metal; polishes very yellow.
49. Common bell-metal 4, regulus of antimony 1; blueish and rough-grained.
50. Common bell-metal 6, regulus of antimony 1; still blueish and rough-grained.
51. Copper 32, tin 14, regulus of antimony $1\frac{1}{6}$, viz. 1 oz. to 1 lb.; too much antimony, it being of a blueish colour, and rough-grained.
52. Copper 32, tin 13, regulus of antimony $\frac{1}{10}$; blueish and rough.
53. Copper 32, tin 13, regulus of antimony $\frac{1}{10}$, viz. 1 oz. to 2 lb.; a very fine metal, in appearance like thirty-three.
54. Copper 32, tin 13, regulus of antimony $\frac{1}{10}$, viz. 1 oz. to $2\frac{1}{2}$ lb.; a beautiful metal, not much unlike forty-seven, but not quite so white.
55. Crude antimony 16, cawk-stone 1 or 2 oz.; a very bright glassy metal, like the common vitrum antimonii, but by no means fit for mirrors.
56. Copper 32, tin 16, vitrum antimonii made from the cawk-stone 1 oz.; a very indifferent composition, as the vitrum antimonii did not differ in its effects from crude antimony.
57. Copper 32, tin 14, lead 2; no art can make this composition mix intimately, as the lead will always separate from the copper and tin.
58. Copper 32, tin 16, regulus of antimony 3; black, and much too rotten.
59. Copper 32, tin 16, iron-filings 8; a blueish-grey colour, and rough-grained, and appeared somewhat like steel when broken through.
60. Fifty-ninth composition 8 oz., tin 1 oz.; a little whiter than the fifty-ninth, but still too blue.
61. Equal parts of fifty-nine and sixty; still of too blue a colour, and not close-grained.
62. Copper 32, tin 16, arsenic 3, iron-filings $\frac{1}{4}$ of an oz.; a pretty brilliant composition, but much inferior to forty-seven.
63. Platina 1 oz., brass 1 oz., cawk-stone red-hot $\frac{1}{2}$ oz.; excessively difficult to fuse, and of a dirty light brown colour, and somewhat malleable.
64. Copper 32, tin 16, iron-filings 4, regulus of antimony 4, and fluxed with corrosive sublimate; an exceeding hard and compact metal, but of too blue a colour.

65. Copper 2 oz., tin 1 oz., iron-filings 1 dr., regulus of antimony 1 dr.; too blue a colour, and rough-grained.
66. Regulus of antimony and tin, equal parts; sparry, and not fit for mirrors.
67. Cast-steel; will not polish upon pitch, either with putty, or colcothar of vitriol.
68. Steel 1, tin $\frac{1}{2}$; very rough-grained and blueish, and not much different from steel itself.
69. Steel 1, tin 1; rough-grained, and of a blueish colour.
70. Steel 1, and forty-seventh composition 20 parts; rough-grained, and not near so good as forty-seven.
71. Steel 1, and forty-seventh composition 30; not much different from the forty-seventh composition, but not so beautiful and close-grained.

"Many other mixtures," says Mr. Edwards, "were tried, by combining the foregoing compositions in more than a hundred varieties of proportions; but none of them were found equal to N^o 47, as that mixture forms a metal that is the whitest, hardest, most reflective, and takes the highest lustre of any thing I have yet seen."

The mixture, therefore, which was at last chosen from these various experiments, was 32 ounces of pure copper, with 15 or 16 of grain-tin, just enough to saturate the copper, 1 of brass, and 1 of arsenic; which composition will be still further improved, it is said in a note, but we believe not correctly, by 1 of silver. The use of the copper was to lessen the extreme brittleness of the mixture; the arsenic rendered the metal close and free from pores; and the silver, it was thought, improved the brightness, without injuring the hardness, when used in a small quantity. This mixture, it will be remarked, very much resembles Mr. Mudge's, who used $14\frac{1}{2}$ of grain-tin to 32 of copper, but without arsenic, or other addition: he found 15 too hard for the blue stone to take hold of; but Mr. Edwards availed himself of another stone, procured at Edgedon, in Shropshire, situated between Ludlow and Bishop's Cattle, which was keen enough to bite a metal with from 15 to 16 of tin to 32 of copper, which composition Mr. Mudge considers to possess a *maximum* of whiteness as well as of hardness. Mr. Mudge, however, says, that one of his belt workmen, called Jackson, found a stone that would cut a metal of one-third tin and two-thirds copper, but the discovery of such stone, which he always kept a secret, cost him the expense of a journey of two hundred miles; which distance exceeds that of Edgedon from London, by about fifty miles; and, therefore, the stones of Jackson and of Mr. Edwards were probably not from the same quarry, if they were similar in kind. Edwards's mode of casting is nearly the same as Mudge's, both as to a first fusing for the ingot, with a second fusing for the speculum at a lower heat; and as to his flasks and sand (procured from Highgate), a small portion of the tin was also reserved to be put into the crucible at the second melting, when also the arsenic, tied up in paper, was put in; and after the fumes of this ingredient had ceased to ascend, the mixture, stirred with a wooden spatula, while no breath was inhaled into the lungs, was poured into the flasks, the moment that about an ounce of powdered resin, or resin and nitre, had been thrown in and melted, to give a good face, as Mudge did with the charcoal dust. The principal difference from Mudge's process is, that in the first melting, after the brass is made as fluid as possible, the brass and silver must be added with the common black flux, of two parts of tartar to one of nitre, or by stirring the melted mixture with a spatula of birch; after which the tin must be added, and the whole poured out into an ingot, as soon as it is found to be in a liquid state; and after the second melting, when the arsenic has been

added, and also the resin, the flasks receive the metal, with the face downwards; the ingate having been made on the back of the metal near its edge, and its breadth increasing to half the diameter of the metal at the place of joining. The upper part of the ingate should contain as much metal in weight as the speculum and the flasks should be opened, and the sand cleared out, while it remains red-hot, with the face still downwards, and then removed by a pair of tongs into an iron pot, containing a large quantity of hot ashes or small coals, sufficient to bury the metal, where it must remain to cool by degrees with the ashes. We must not, however, omit to mention one precaution, on which some artists seems to be laid, *viz.* that when the pattern, with its ingate, or git, is taken out of the sand, ten or a dozen small holes must be made through the sand at the back of the mould, with a small wire, or common knitting-needle, to permit the air to escape while the liquid metal is filling the mould, which are safer than one large hole: also at the second melting, the flasks must be jogged with a slight stroke or shake, as soon as the fluid metal is poured in, to prevent flakes or air-bubbles being formed on the face of the metal. The git may be taken off, when the metal is quite cool, with a common fine half-round file, to make an incision, after which a gentle blow will remove it. If, however, the metal is cast from a mould too thick, it will not take the parabolic figure. For a speculum of $4\frac{1}{2}$ inches diameter, and 18 inches focal length, the thickness should be $\frac{1}{16}$ ths of an inch at the edge, and the back should be convex, so as to allow the whole metal to be of uniform thickness when ground, in order that it may not yield to the pressure, or incumbent weight, during the grinding and polishing. The handle should be made of the same concavity and convexity as the metal, but double its thickness, and only three-fourths of its diameter; it should also have a hole through the centre, to receive a screw going into the chuck of a lathe, in order that the edge of the metal may be formed, first by a file, and then by a stone from Edgedon, while it is revolving.

The speculum being cast by these directions, is next rough-ground on a common grinding-stone, formed by a bar of steel, while revolving, to the radius of convexity suitable for making the desired concavity of the metal; after this rough-grinding, two tools are all that are requisite; a convex tool made of lead and tin, or else of pewter, and a bed of hones, of the sort already mentioned; for the convex tool serves also for a polisher, in conjunction with its coat of pitch and *colcothar of vitriol*, which is preferred to putty: the polish from the latter is indeed of a white silvery hue, but that from the former gives a fine dark lustre, like the complexion of polished steel, which is deemed preferable. The colcothar, to be good for this purpose, must be of a deep red or purple colour, must dissolve in the mouth without gritty lumps, and feel soft and oily to the touch. It may be levigated with a little water between two bars of polished steel, and worked with two or three additions of water, till it acquires a dark and nearly black colour, when it will be fine enough to be put into a bottle with water for use. We will not repeat all the processes to be attended to in the use of the convex tool, and of the bed of hones, which we have sufficiently detailed under our article GRINDING, but remark only on their dimensions and shape, which form essential considerations in Mr. Edwards's mode of grinding, polishing, and particularly of giving the requisite figure without a succession of tentative operations. The bed of hones should be of a circular figure at the circumference, and in every respect the segment of a sphere, with a diameter just $\frac{1}{16}$ ths of an inch wider than that of the metal, when it is

SPECULUM.

four or five inches in diameter; and the reason is, that if it is much larger, it will enlarge the circle of concavity of the metal worked on it. The convex tool must not, however, exceed the speculum in diameter more than $\frac{1}{7}$ th of an inch, otherwise it will enlarge the radius of concavity too much. Much water used with the bed of hones is detrimental to the figure, and therefore must be avoided in bringing out the scratches of the grinding-stone, and in producing a true spherical face. We have said nothing hitherto of the *shape* of the rough grinder, or convex tool, to be used also as a polisher; this must be *elliptical* at its circumference, and the longer diameter must be to the shorter exactly as 10 to 9, the latter being just equal to the diameter of the speculum to be ground and polished by it. This proportion has been found by experience to give the *parabolic* figure in specula of ordinary dimensions, by the common mode of using the tool in all directions; which discovery by Mr. Edwards gives him a claim to originality of method, as well as of simplicity and certainty in the operations, independently of superior skill in the operator. This elliptical tool is used first after the grinding-stone with fine emery and water, before the bed of hones, and again with the colcothar and water as a polisher, and during the latter operation, it is said to give also the parabolic figure. The preparation of this elliptical convex tool, as a polisher, is thus effected. The pitch is made by boiling tar in a ladle or crucible over a very slow fire, till it is very hard when tried cold, and with this an equal quantity of resin is melted, which prevents too much brittleness, and makes a good, hard, unelastic coat for the reception of the colcothar. With regard to the requisite *hardness* of the pitch, Mudge and Edwards seem to differ in opinion; but as the metal of Edwards is harder than that of the other, and as he uses a different powder for the polish, each opinion may be well founded, so far as relates to his own mode of polishing. The pitch, or pitch and resin, being melted in a crucible, is poured on the heated elliptical tool, and spread to the thickness of a half-crown, with an iron spatula; when it is cooled a little, a sheet of writing-paper is laid on it, and is pressed equally with the concave face of the speculum itself, which does the work of Mudge's concave tool in this respect; and when the paper is removed, it will be seen, by the fine furrows of its face made thereby, whether or not the impression of the speculum has, at the first trial, given its counterpart to the pitch all over; if not, a second impression must be taken in like manner, after the pitch has been softened a little before a fire; otherwise the face of the speculum might have been dipped in water, to prevent adhesion, and then the paper might have been diffused with. The superfluous pitch must now be removed from the edge of the elliptical polisher, and a cone of wood inserted into its central ball, to make it perfectly round, like the hole of the metal before the coating was poured on. The pitch is next saturated with the colcothar and water, and then polishing commences, and is continued, without any particular attention to the strokes, more than is necessary for giving the polish, and when that is finished by cross strokes given in all directions, as usual, the parabolic figure is ensured by the variable dimensions of the polisher's diameter. Lastly, the final polish is nearly attained when black mud is generated quickly on the surface of the metal, which must be partially, but not entirely, wiped off at intervals, till the business is finished, when the truth of the figure and goodness of the metal may be put to the proof that we have described in our former article, as recommended by Mr. Mudge; or may be tried by Edwards's more convenient test, which we shall presently describe.

Since we made the preceding abridgment of Edwards's

directions, we have seen an extract from one of his letters to Dr. Maskelyne, containing *an addition* to his former directions, which, as it is short, we will here subjoin. "Make the brilliant composition first of copper and tin. Melt the proportional quantity of silver and brass in a small crucible by itself. When you put the brilliant composition the second time into the crucible, add also the lump of brass and silver melted together before in a separate crucible; and when the whole is now fluid, add the proportional quantity of arsenic, and then pour it off into the flasks, after the scoria is taken off, and a little powdered resin is thrown into it." The reason assigned is, that as copper requires more heat to melt it, than either silver or brass does, if the brass were put into the high heat of melting copper, its lapis calaminaris would calcine, which will not be the case when the ingot is made liquid by the lower heat of the second melting. The best fuel that Edwards found for melting the metal was coal-coke, as prepared by the maltsters, which casts no smoke, and is more lasting than charcoal: he also found, that the blueish hue of crown-glass used for the eye-piece, best corrects the yellowish colour of objects, as shewn by a speculum, and particularly when N^o 47 is the composition chosen. In trying the figure of the great speculum, Mr. Edwards rejects the diaphragms of Mr. Mudge as unnecessary, and adopts a more simple method, thus; when the specula and eye piece are in their places, he fixes a circle (of white paper probably) of half an inch, or an inch in diameter, at the distance of from fifty to one hundred yards, and gives it a broad black annular margin, by way of contrast; then, when the telescope is adjusted nicely to distinct vision thereby, the screw that moves the small mirror must be turned either way, until a *dark haze* surrounds the circle, (or field of view,) which will become broader and broader the further the screw is turned; now, if the haze is more distinct, and the edge of it better defined when the screw turns to the right hand, or brings the small speculum nearer, from the point of distinct vision, than when the motion is in a contrary direction, the figure of the great speculum is *spherical*; but if, on the contrary, the edge of the haze is better defined by the opposite motion, then the figure is *hyperbolic*; and, lastly, if at equal distances on each side of the true focal point the appearance of the haze is the same, the figure is known to be properly *parabolic*, and fit for its office. The small speculum, in the Gregorian construction, being placed to receive converging rays from the large one, is required to be spherical, as we have before said; but in the Newtonian construction it is made plane, and of an oval shape, to reflect the rays to the eye, placed at an angle of 90°. Mr. Edwards says, he received his instruction how to grind and polish one of these from his friend, Mr. (now Dr.) Herschel, when he lived at Bath. To grind one of the *elliptical specula flat*, a small tool of lead with emery is first used, and then two or more considerably larger ones are used; both the tools and bed of hones should not be less than six inches in diameter. The figure of the tools is not considered to be completed, till the speculum can be first highly finished upon one of them, and afterwards be applied to another, without receiving any change: the last half dozen strokes should be in the direction of the longer axis of the ellipsis. When this is perfected, it must be polished upon the pitch-polisher, of a circular form, the diameter of which is greater than the transverse axis of the speculum by *one-tenth*. As Mr. Edwards speaks of Mr. (Dr.) Herschel as his friend; and as the doctor has not, that we know of, yet published the composition of his metal and mode of grinding, polishing, and

figuring it; we may conclude that he practises Mr. Edwards's process, and particularly as Mr. Edwards gives us the following information in the postscript of his pamphlet. "Mr. Herschel chiefly makes use of a Newtonian reflector, the focal distance of whose great mirror is seven feet, its aperture 6.25 inches, and powers 227 and 460 times, though sometimes he uses a power of 6450 for the sixth stars. Note, if the metals of a Newtonian telescope are worked as exquisitely as those in Mr. Herschel's seven-feet reflectors, the highest power that such a telescope should bear, with perfect distinctness, will be given, by multiplying the diameter of the great speculum by 74; and the focal distance of the single eye-glass may be found, by dividing the focal distance of the great mirror by the magnifying power: thus, $6.25 \times 74 = 462$, the magnifying power; and

$$\frac{7 \times 12}{462} = 0.182 \text{ of an inch, will be the focal length of the}$$

single eye-glass required." When we arrive at our article TELESCOPE, we trust that we shall be able to lay before our readers more minute information respecting the specula, as well as other parts of Dr. Herschel's wonderful instruments, than we have room for in our present article.

Supposing now Mr. Edwards's specula to be finished, it remains that we say a few words respecting his mode of fixing them in his tube, to give a distinct image of the object to be viewed, without which they would be useless. When the large speculum is made to rest against the inner end of the tube for which it is adapted, the arm which carries the small speculum must be first adjusted: in order to do this properly, extend first two fine threads, or wires, across the aperture of the tube at right angles, so as to intersect each other exactly in the axis of the tube; before the arm is finally fastened to the slider, place it in the tube, and through the eye-piece, without glasses, let the eye be directed to the screw-hole in the end of the arm, and if the point of intersection of the cross-wires be at its centre, the hole is in the axis, but not otherwise. When this exactness is obtained by mechanical means, the arm may be there made fast to the slider. In the next place, the small speculum must be placed parallel to the large one, thus; cut a piece of card into a circle about one-half or two-thirds of the diameter of the mouth of the tube, and fix it concentrically at the mouth with a piece of stick, that shall bisect the tube, to the middle of which the circular cord may be tied, so as to exclude all the light, except an annular portion at the circumference of the tube; this being done, turn the telescope to the sky, and the annular light that falls on the great speculum will be reflected on the little speculum, on which it will form an annular light also of smaller dimensions. Now, if the breadth of this small ring of light is observed to be equally broad at every side of the small speculum, the position thereof is parallel to that of the large one, but if not, it must be adjusted till this is the case. But it may so happen, that this adjustment may put the centre of the small speculum out of the axis of the tube, which may be detected thus; examine again the annular light, and take notice whether or not the ring is concentric with the circumference of the metal; if not, it must be made so by the screws of adjustment, or otherwise. In order to be certain that these adjustments of the small speculum are accurate, turn the telescope again to the small circle of paper with a black margin, with the tube quite open, and having made its image concentric with the small speculum at the point of distinct vision, alter the focus by moving the small speculum gradually, till the black margin becomes a black spot, or point; and if this spot lie on the

centre of the small speculum apparently, the two adjustments, for the axis of vision, and for parallelism, are both correct. Again, if a star of the first magnitude appear perfectly round and well defined; and also if the small stars, in the double stars, are well seen, these are proofs of the excellence not only of the figure and polish of the metal, but likewise of all the adjustments.

We have only to add further to what we have said of Edwards's metal and process, that on conferring lately with some of the most eminent opticians of the present day, their opinion is, that reflecting telescopes are brought as near to perfection as art and experience can effect, by Watson, Tulley, and others, but that it is not necessary to adhere rigidly to Mr. Edwards's, any more than to Mr. Mudge's directions; the Edgedon stones, for instance, do not answer the description given of them for cutting the hardest metals, which are always the best when the colour is proper; (the density of which, we understand, may be determined by their specific gravity, without the trouble of previous polishing); neither is a bed of hones indispensably necessary; as the finest emery, that washes off in grinding, may be again used to give a smooth surface before polishing, as the Tulleys, father and son, have sometimes done, perhaps more out of curiosity than choice, and have thus begun and finished the process with only *one tool*, unless the speculum itself be called a tool for equalizing the pitch. Lord Stanhope, and his operator, Mr. Varley, who are engaged in making experiments in polishing specula, have used Welsh slate with success for composing a bed of polishing materials; and no doubt there are various stones not tried that may hereafter prove superior to those hitherto used for this purpose. The brass and silver recommended by Edwards are, moreover, now generally omitted by the best opticians, as tending to diminish the hardness of the metal more than is requisite; but the arsenic is still retained. And, lastly, the property of the *elliptic* tool, ascribed to it by Edwards, is disallowed by several of the most skilful opticians; so that, after all, each workman succeeds best when he practises the methods of grinding, polishing, and giving the requisite figure, in which his own skill and experience have rendered him most expert, and consequently most confident.

SPECULUM, *Horizontal*. See HORIZONTAL.

SPECULUM. This name is given to several instruments employed in *Surgery*, for gaining a view of tumours, or ulcers, situated within cavities. Thus, there are specula ani, specula auris, &c. The speculum oculi is an instrument for opening the eye-lids, and keeping them apart, so that the surgeon may have a good view of the eye.

SPECULUM *Musica*, the title of a musical treatise, written in Latin by John de Muris, (see MURIS), and only to be found among the MSS. in the late king of France's library, at Paris. It is a treatise so ample, and so scarce, that, having procured large extracts from it, and a complete table of its contents, we shall be the more minute in our account of it, as it seems to have been the ground-work of all the musical treatises that were produced by other writers, till the time of Franchinus Gaforius, in the latter end of the 15th century.

This work, which is written on vellum, in folio, contains six hundred pages. The first sentence of the original is, "Libro tertio de Philosophica Confolatione Boetius volens reddere Causam," &c. It is divided into seven books: the first of which treats of the invention of music, and of its divisions, and contains 76 chapters; the second, of musical intervals, 123; the third, of harmonics, or musical proportion, 56; the fourth, of concords and discords, 51; fifth, of the ancient tetrachords, division of the monochord, and doctrines

doctrines of Boethius, 52 chapters; sixth, of the modes and notation of the ancients, of the changes made in their system by Guido, and of the ecclesiastical tones, 113. Book the 7th, of measured music; of discant, in treating of which he has the chapter "de ineptis Discantoribus," part of which has been given in the preceding chapter; of the time-table, moods or divisions of time; of the folly of placing a tail to the semibreve, by which he seems to mean the minim, without naming it; of perfect and imperfect measures; and lastly, a parallel between ancient and modern music, which occupies the last five of the 45 chapters into which this book is divided, the concluding sentence of which is, "Exempli causa describere tibi volo quorum figuræ sunt in hoc ordine consequentes."

Explicit Tractatus Musicæ, Magistri
Johannis de Muris."

Notwithstanding all the nice and subtle divisions and subdivisions of his seven books into 917 chapters, the practical musician would at present profit but little from the study of them, as almost all the doctrines contained in the first five books are speculative, and such as may be found in Ptolemy, Boethius, and other ancient authors, whom almost all the musical writers of later times have copied in pure pedantry, without understanding themselves what they read, and consequently without conveying any useful science to their readers by what they have written. It is only in the two last books that De Muris condescends to speak of the practical music of his own times: in the sixth book he treats of the ecclesiastical tones, notation, and chants, which John Cotton and Walter Odington had done before; and in the seventh he defines cantus mensurabilis, discant, moods, characters of the different duration of sounds, as the long, breve, semi-breve, and their perfection and imperfection. Here he employs several chapters in refuting such as have disputed his doctrines; and lastly, he draws a parallel between the music of the ancients and that of the moderns, in order to ascertain their several degrees of perfection.

It is in mere charity to the curious in musical antiquities that we have bestowed so much pains in examining and describing this book; which, though of difficult access, and more difficult perusal, might tempt them, from the celebrity of the author, to explore its dark regions, and impair their eyes and patience in search of scientific treasures which it does not contain.

SPECULUM *Veneris*, in *Botany*, a name borrowed from the Flemings, given by Gerarde to an annual species of *Campanula*, common in gardens, and remarkable for the brilliancy of its deep-blue flowers with a white centre. Linnæus has retained this as a specific name, and the plant is commonly called Venus's Looking-glass. See *CAMPANULA* and *PENTAGONIA*.

SPEEAN, in *Rural Economy*, provincially used to signify to wean from the dams, as calves, hogs, lambs, and other animals.

SPEEAVE, provincially to say or cut young animals.

SPEECH, the act, or art of expressing a man's thoughts, by certain signs invented for that purpose.

These signs are principally sounds made by the voice, and letters. See *LANGUAGE*.

SPEECH, in *Grammar*, denotes an assemblage of several words ranged in order.

The grammarians generally make eight parts of speech, *i. e.* eight kinds of words used in discourse; *viz.* noun, pronoun, verb, participle, adverb, conjunction, preposition, and interjection; each of which see under its proper article.

F. Bussler, one of the last writers on grammar, only admits of three parts of speech, *viz.* noun, verb, and

modificative; which last includes the *adverb, conjunction, and preposition*.

The ingenious Mr. Harris, after Aristotle, distributes all words into four species, *viz.* substantives, or nouns; attributives, or verbs; definitives, or articles; and connectives, or conjunctions; the two former are principals, or significant by themselves; and the two latter are accessories, or significant by relation. Under these four species are included pronouns, adverbs, prepositions, and interjections. *Hermes*, p. 31.

SPEED, JOHN, in *Biography*, a considerable elucidator of the geography and history of Great Britain, was born in 1552, at Farrington, in Cheshire. He was brought up to the trade of a tailor, and was, by apprenticeship, a freeman of the company of Merchant Tailors in London, when that patron of learning, sir Fulk Greville, discovering his attachment to the antiquities of his country, gave him an allowance to enable him to quit his employment, and devote himself to study. His first publication was entitled "The Theatre of the Empire of Great Britain, presenting an exact Geography of the Kingdoms of England, Scotland, and Ireland, and the adjacent Isles." This work consisted of a set of maps of all the counties, with the ichnography of the principal towns, and brief descriptions, mostly copied from Camden's *Britannia*. His greatest work, the labour of fourteen years, entitled "The History of Great Britain," appeared in the year 1614. It is chiefly a compilation from preceding authors and manuscript records, comprising all the events in British history, from the invasion of Julius Cæsar to the reign of king James I.; and though rude in style, yet it contained more valuable matter, and is better arranged, than the preceding chronicles. Speed, it is said, was the first English writer who, slighting Geoffrey's tales, fell upon more solid matter. He was assisted by sir Robert Cotton, who revised and corrected the whole. Mr. Speed was author of a work entitled "A Cloud of Witnesses, or Genealogies of Scripture," prefixed to the new translation of the Bible in 1611, and to several subsequent editions of it. This useful and industrious man passed 57 years in the marriage state, with a wife, by whom he had twelve sons and six daughters. He died at London in 1629, and was buried in the church of St. Giles, Cripplegate.

SPEEDWELL, in *Botany*. See *VERONICA*.

SPEEDWELL, *Female*. See *ELATINE*.

SPEEDY-CUT, a term used to signify a kind of cut which happens to a horse when put to his speed. See *SHOEING of Horses*.

SPEEN, or *Spaenham Land*, in *Geography*. See *NEW-BURY*.

PEGEL, HAQUIN, in *Biography*, a Swedish archbishop, distinguished for great learning, was born in 1645. After acquiring the rudiments of a good education, he was sent to the academy of Greifswald; made a tour to Germany, Holland, England, Denmark; and on his return took his degree of master of arts at Lund, in 1671. The same year he was appointed chaplain to Charles XI., whom he accompanied in his campaigns during the whole Dutch war. In 1685 he was made bishop of Skara, was translated thence to Linköping in 1691, and in 1711 was raised to the archiepiscopal chair. After the fire which took place at Linköping in 1700, he contributed by his active exertions towards rebuilding the Gymnasium, a service of so much importance, that the remembrance of it is still preserved by an inscription on the front of the building. He augmented the library with a great number of excellent books, and on the death of his son, presented to it a collection of medals and coins. He died at Upsal, in 1714. Among his works, which

which were numerous, are the following: "A History of the Swedish Church; or a Chronicle of the Bishops, in two Parts;" "Sermons on Christ's Sufferings;" "Glossarium Linguae Gothicae;" besides a great number of hymns, and various sermons.

SPEIGHT'S TOWN, in *Geography*, a sea-port of the island of Barbadoes, situated on the west coast, near the northern part of the island, formerly much frequented by the Bristol traders, and thence called Little Bristol. It is a handsome town, containing about 350 well-built houses, disposed into four regular and spacious streets, of which the longest is called Jews'-street, and, with the other three, leads down to the water side. The planters in that part of Barbadoes called Scotland, used to ship off their goods here for England, which occasioned the building of store-houses, and a concourse of people, to the great advantage of the town; but most of the trade is now removed to Bridge-town. It has a spacious church, dedicated to St. Peter, which gave name to its precinct, and is the place where the monthly sessions are held. The town is defended by two forts, besides another in Heathcote's bay, some distance south of the town. One of the above forts stands in the middle of the town, and is mounted with 14 guns; the other, which hath 32, stands at the north end of it: but there are, besides these, several platforms on the sea-shore. N. lat. $13^{\circ} 15'$. E. long. $58^{\circ} 31'$. Edwards's West Indies.

SPEISSE, in *Mineralogy*, a name given by the Germans, and other workers on cobalt, to a sort of impure regulus of bismuth, sometimes occurring in their processes.

It is not uncommon for ores of bismuth to be mixed with the cobalt in the smalt-works. Both this ore and the cobalt yield the blue vitrifiable earth of which smalt is made; but in one of them it is blended with arsenic, and in the other with the bismuth. The separation of it from these two minerals requires different processes, and the workmen, therefore, separate the two minerals, and work each by itself; but it sometimes happens that the ore of bismuth is so like to the true cobalt, that it cannot be distinguished by the eye, and so intimately mixed with it, that it cannot be separated from it; in this case the whole is exposed to the fire together, and after the arsenic is sublimed in form of meal, there remains a coarse and impure regulus of bismuth, which having mixed itself with the earth of the cobalt, and other extraneous substances, is of a reddish-white colour, and very impure and friable. This gives them the trouble of a second operation, by which they separate the pure regulus of bismuth, and the remainder being a mixture of its earth and that of the cobalt, is run together into the blue glass called *smalt*, the earth of bismuth ore being of the same nature with that of cobalt. Phil. Trans. N^o 396, p. 199.

SPEL, in *Rural Economy*, a term provincially used to signify a bar. It also signifies the thin straight or bent ribs in the work of basket or sieve-making in some places.

SPELE, in *Geography*, a town of the island of Candy; 15 miles S.E. of Candy.

SPELK, in *Rural Economy*, a small thin rod, or piece of wood used in thatching. Small hazel rods are mostly employed in this way.

SPELL, a kind of charm, to drive away a disease, by hanging a word or sentence written on a paper about the neck. See **CHARM**.

SPELL, in *Sea Language*, the period in which a sailer, or gang of sailers, is employed in a particular exercise, from which they are relieved as soon as the limited time expires. Such are the spells to the hand-lead in sounding, to the pump, to look out on the mast-head, &c. and to steer the ship, which last is generally called the *trick*.

Spell also implies the relief or return of duty to those services: thus it is said, spell the pump, spell the lead, &c.

SPELLING, that part of grammar properly called orthography.

Dr. Jones gives the following rules, or maxims, of spelling.

1. That all words were originally pronounced as spelt.

2. That in all words whose sounds have been since altered (the origin of the difficulty of spelling), the alteration was made for the sake of ease and pleasure.

And hence, 3. All words that can be written several ways, must be spelt according to the hardest, harshest, and most unusual sound.

SPELLO, in *Geography*, a town of the Popedom, in the duchy of Spoleto. This was anciently Hispellum, and being made a Roman colony by Julius Cæsar, was by him named Colonia Julia Hispella. In the year 1529, it was sacked by Philibert de Châlons, prince of Orange, general of Charles V.; and three years afterwards the walls were ordered to be pulled down by pope Paul III.; 10 miles S.W. of Nocera.

SPELMAN, Sir HENRY, in *Biography*, an eminent antiquary, was descended from an ancient family settled in Norfolk. He was born in 1562, at Congham, near Lynn, and having received a common education, he was sent at an early age to Trinity college, Cambridge. Owing to his father's death, he was called from the university before he had completed his 17th year, and he was afterwards entered of Lincoln's-Inn, in order that he might study the common law, but his inclination was not favourable to legal pursuits: he seems to have given a decided preference to polite literature and antiquities, but these pursuits were cut short by an early marriage, which induced him to settle upon his estate, and take the management of it in his own hands. He did not, however, abandon his antiquarian pursuits, and while he was yet a very young man, he drew up a treatise in the Latin language, entitled "Aspilogia," relative to armorial bearings, and made transcripts of several charters of monasteries in Norfolk and Suffolk. He was also associated to the original society of antiquarians, and became the intimate friend of Cotton, Camden, and other favourers of that class of studies. In 1604 he was elected high sheriff of the country, and about the same time communicated to Speed a description of Norfolk, for his work entitled "The Theatre of Great Britain." In 1607 he was nominated by the king one of the commissioners for settling the titles to lands and manors in certain counties of Ireland, and on this occasion he went thrice to that country. Farming now became irksome, because he probably found it unprofitable: he sold off his stock, let his estates, and came with his family to London, and he chose as the particular object of his studies, the antiquities of English law, as deducible from English records; but he was diverted from his object by an incidental subject. During his residence on his estate, he had purchased the lands of two suppressed monasteries, and being involved in a troublesome law-suit in order to defend his title, he began to entertain scruples concerning the secularization of property once belonging to the church. When, therefore, an uncle of his complained to him of difficulties which he had met with in building upon the glebe of an impropriate parsonage, he plainly gave his opinion, that it was a token of divine displeasure for keeping the parsonage in lay hands, and he drew up a work in 1613, with the title "De non tementandis Ecclesiis; Churches not to be violated; a Tract of the Rights and Respects due to Churches, &c." He practised what he had pleaded for in theory, and being possessed

ferred of an impropriation in Norfolk, he devoted the profits of it to the augmentation of the vicarage.

By king James he was knighted, and on the revival of the society of antiquarians in 1614, he attended as one of the old members; on which occasion he wrote "A Discourse concerning the Original of the four Law Terms of the Year." His zeal for the honour of the church and the authority of the canons, induced him to write a tract in answer to an apology for archbishop Abbot, who had accidentally killed his game-keeper, in which he maintained that the prelate by that act had ceased from his office, and could not be reinstated without a new consecration. Having in the mean time continued his enquiries into legal antiquities, he found that the knowledge of the Saxon language was absolutely necessary to his purpose, which he accordingly set about obtaining, and in 1621 he printed a specimen of his proposed work, which was so much approved, that several eminent scholars urged him to its completion. In 1626 he published the first part, under the title of "Archeologus, in modum Glossarii ad rem antiquam posteriorem." Notwithstanding the applause of the learned, the author was not encouraged by the sale of his work to publish the second part during his life, which he had fully prepared for the press. It was, however, given to the world after his decease, and the whole was entitled "Glossarium Archaologicorum." The object of this work is the explanation of obsolete words occurring in our laws; and it is not a mere glossary, but contains various entire dissertations. He next employed himself in a collection of English laws and statutes, from the Conquest to the ninth year of Henry III., which was printed in 1617. Having been appointed, on the recommendation of archbishop Laud, one of the commissioners for enquiring into the exaction of fees in the courts and offices throughout England, he published, in 1628, a tract "De Sepultura," or concerning "Burial Fees." Before our author had finished his glossary, he engaged in another considerable work, which was "A History of the English Councils." Of this he published in 1639 the first part, which included the period from the first introduction of the Christian religion into England to the Norman Conquest. A second part, only a small portion of which was of his own composition, was printed several years after his death. In the same year he instituted a Saxon lecture in the university of Cambridge, which he intended to have rendered perpetual, but his design was defeated. In 1639 also he published a treatise on "The original Growth, Propagation, and Condition of Tenures by Knights' Service in England," in which he displayed an extent of learning that proved his faculties to be perfect, notwithstanding his advanced age. He lived to complete his 80th year, and died at London in 1641. By the king's order, he was interred in Westminster Abbey. After his decease, two posthumous works of his were published, *viz.* "A Treatise concerning Tythes," printed in 1647; and "A History of Sacrilege," which was destroyed at the printer's by the great fire of London, and a plan of it only preserved. In 1698 bishop Gibson published a folio volume, entitled "Reliquiæ Spelmanniæ," containing a number of his posthumous tracts relative to the English laws and antiquities. He was, says his biographer, a very respectable promoter of antiquarian learning, and a man of great private worth.

SPELMAN, EDWARD, great-grandson of the preceding, resided at High-House, near Rougham, Norfolk, where he died in 1767. He had devoted himself to literature, and made himself known by several publications of considerable worth. The first of these was a translation of Xenophon's "Cyropædia," in two volumes, 8vo. A more elaborate

work was entitled "The Roman Antiquities of Dionysius Halicarnassensis," translated into English, with notes and dissertations, in four volumes, quarto, a work which stands high among our translations from the Greek language. One of these dissertations was a version of a fragment of Polybius on government, particularly that of Rome, to which the translator prefixed a preface, applying the system of Polybius to the English government. This was printed without his name in 1743. He also printed for the use of his friends, and for private distribution only, "A Dissertation on the Presence of the Patricians in the Tributa Comitia:" and after his death the Rev. Mr. Lemon published in 1775, a posthumous work of this writer, entitled "Additional Observations on the Greek Accents." Gen. Biog.

SPELT, in *Agriculture*, a term applied sometimes to wheat-grass, a species of *tritium*, or wheat. It is sometimes written *spelta*.

SPELTA, in the *Materia Medica*, a name used for the grain of the *zea dicoccos*, commonly called *spelt-corn*.

SPELTER, or SPELTRE, a name sometimes given to zinc.

SPELUNCATO, in *Geography*, a town of the island of Corfica; 12 miles E. of Corte.

SPENAZZOLA, a town of Naples, in Basilicata; 13 miles E. of Venosa.

SPENCE, JOSEPH, in *Biography*, was educated at New college, Oxford, of which he afterwards became a fellow. He took the degree of M.A. in 1727, and in that same year made himself known by "An Essay on Pope's Translation of the *Odyssey*." This work displayed a cultivated taste, as well as a sensibility to the beauties of poetry, and was so favourable to the translator, that he sought his acquaintance, and admitted him to a familiar intimacy. In the following year he was elected professor of poetry of the university of Oxford, an office which he held for ten years. After this he travelled with the young duke of Newcastle, and in 1742, having quitted his fellowship, he was presented by his college to a rectory in Buckinghamshire. He resided, however, at Byfleet, in Surrey, at a mansion lent him by the duke his pupil, and thus performed the duties of rector merely by an annual visit, attended with liberal charities. In the same year he was elected king's professor of modern history, at Oxford: this was a duty as easy to be performed as the other, but he did not devote that leisure which his preferments offered him to indolence, for in 1747, he brought to the press his principal work, entitled "Polymetis, or an Enquiry concerning the Agreement between the Works of the Roman Poets and the Remains of ancient Artists, being an Attempt to illustrate them mutually by each other." This was a folio work, with plates. The performance was extremely well received by the public, and still stands very high in the literary world, though it has been slighted by some few, who perhaps hastily condemned, before they had given proper attention to it. In 1754 he was presented with a prebendary of Durham, and he continued to amuse himself with a variety of miscellaneous compositions that appeared in different forms. His last publication was an edition of "Holdsworth's Remarks on Virgil," with notes, and additional observations of his own. In the month of August, 1758, he was found drowned in a piece of water in his own garden at Byfleet, into which it is supposed he had fallen in a fit, the water being 100 fathoms to cover him. He is characterised as being of a social benevolent disposition, and being very much beloved by his friends. He was studious to draw obscure merit into notice, of which he gave evident proofs by his printed account of Stephen Duck; Robert Hill, the learned tailor; and

and Mr. Blacklock, the blind poet. Several of his detached and miscellaneous compositions were inserted in the "Mufæum," and in Doddsley's "Fugitive Pieces." He had collected some MS. volumes of anecdotes of eminent writers, communicated by Pope and others, which are still in the possession of the duke of Newcastle's family, and from which Dr. Johnson was permitted to make extracts for his lives of the poets. Gen. Biog.

SPENCER, JOHN, a learned divine of the church of England, was born in 1630, at Bocton-under-Bleane, in Kent. His father dying while he was an infant, the care of educating him was undertaken by an uncle, who sent him to the free-school of Canterbury. His proficiency in learning procured for him a recommendation to a scholarship in Caius college, Cambridge, where he was admitted in 1645. Passing through the usual gradations in that university, he was chosen fellow of his college in 1655, and took orders: of course he must have complied with the requisitions of the ruling powers at that time. He became distinguished for his pulpit compositions, and was appointed university preacher, in which capacity he took an opportunity of hailing the event of the Restoration by a thanksgiving sermon, which was printed under the title of the "Righteous Ruler," which, in reference to the profligate character of the restored sovereign, must have been regarded as extremely appropriate! Some enthusiasts having, in a periodical paper entitled "Annus Mirabilis," brought to notice a number of pretended prodigies, as portending future changes in the state, Spencer conceiving it to be of dangerous consequence thus to unsettle the minds of the people, published in 1663, "A Discourse concerning Prodigies," wherein a variety of presages by them is reprehended, and their true and proper use is asserted and vindicated. A short extract from the preface will shew the nature of the work: "We have," says he, "of late been persuaded by three or four several impressions of books, that England is grown Africa, and presents us every year, since the return of his majesty, with a new scene of monstrous and strange sights; and all held forth to the people, like black clouds behind a storm, the harbingers of some strange and unusual plagues approaching to the state; and this by persons pretending an intimacy with scripture, and the fathers, Greek and Latin, ancient and modern writers." The work displayed a freedom from credulity and superstition very laudable at that time. To a second edition, in 1665, was added "A Discourse concerning vulgar Prophecies;" in which the vanity of receiving them as the certain indications of any future event is discovered, and some characters of distinction between true and pretended prophets are laid down. This attempt to bring down the public to reason and sobriety was not less timely than the former, and might have been usefully renewed in many other instances and at much later periods. The author in the same year proceeded doctor in divinity. He was, in 1667, presented to a living by his college, and in a very short time after was elected to the mastership of that society, an office which he held with high reputation during twenty-six years. Several preferments were bestowed upon him, of which the last and most considerable was the deanery of Ely in 1667. He had previously been chosen vice-chancellor of the university of Cambridge, and in that quality he made a speech to the duke of Monmouth, when he was installed chancellor, which was printed by Hearne, in his work entitled "Vindiciæ Thom. Caii." It was particularly as a master of Hebrew literature and antiquities he is known in the learned world. His first work was written in the Latin language, a dissertation "De Urim et Thummim,"

which was published in the year 1678. This was a forerunner of his great work, "De Legibus Hebræorum Ritualibus, et earum Rationibus, Libri Tres," 2 vols. fol. 1685; a performance considered so valuable and important, that it was reprinted at the Hague in 1686, and at Leipsic in 1705. The grand object of this work is to prove, in detail, that the rites and ceremonies of the Jewish religion were instituted in direct opposition to the practices of the surrounding idolatrous nations, and in order to establish the strongest distinction between the Jews and them. The same hypothesis has been maintained by several learned men, and has been opposed by others, without affecting on either side the authority of that religion. Spencer's work is still considered as the most complete and judicious treatise in that view of the question. The author died at the age of sixty-three, and he was interred with great solemnity in the chapel of his college, to which society he was a liberal benefactor. He left behind him many MS. additions to his great work; which were entrusted to the care of bishop Tennison, by whom they were bequeathed to the university of Cambridge, and were eventually published in four books, under the care of professor Capellow, in two vols. folio. Biog. Brit.

SPENCER, in *Geography*, a township of America, in Worcester county, Massachusetts, taken from Leicester, and incorporated in 1733, containing 1453 inhabitants; 11 miles S.W. of Worcester.

SPENCER, a large post-township of New York, the capital of Tioga county, is situated near the centre of that county, 50 miles S.E. of Bath; bounded N. by Cayuta and Danby, E. by Candor, S. by Otwego, and W. by Chemung. Spencer was divided in 1811; and Cayuta, Danby, Caroline, and Candor, erected into separate towns from the N. and E. parts. The population of Spencer in 1810 was 3128. It is well supplied with small creeks and mill-streams. The Catetant winds across the northern part with numerous branches; the Cayuta forms the western boundary; and some smaller streams spread over the central part. The soil is of various qualities, and the surface has a considerable hilly aspect, covered with a great variety of forest-trees. The seat of justice for the county has been lately removed from Elmira to this township, and the county buildings are within Drake's settlement, as it is called, situated on the Catetant creek; where is a small village, denominated Spencer; and as its situation is pleasant and healthy, and it is the centre of county business, it promises to become a flourishing county village.

SPENSER, EDMUND, in *Biography*, one of the most distinguished English poets, was born in London about the year 1553. His parents were in humble life, though in his works he claims kindred with the noble family of the Spensers of Northamptonshire. Of his early education nothing is known, but it appears that he was, in 1569, a sizer in Pembroke college, Cambridge. He, in proper time, took his degrees, and in 1576 he was candidate for a fellowship, but was not successful. This disappointment was probably the cause of his quitting the university, which he left for a residence among his relations in the north of England. Here, it appears, he fell in love, and the object of his affection, whom he has commemorated under the name of Rosalindo, after leading him through the usual vicissitudes of a love adventure, finally deserted him. This circumstance is said to have given him a turn to pastoral poetry, since his "Shepherd's Complaint," which is devoted to amorous complaining, was his first publication. It was published in 1579, and dedicated, under the signature of Immerito, to Mr. afterwards sir Philip Sidney. He was introduced to the acquaintance

of this celebrated person by his friend, Mr. Gabriel Harvey, previously to his publishing his "Shepherd's Calendar," which sufficiently refutes a tale concerning his being first made known to sir Philip Sidney by a passage in the Faery Queen, and the munificent reward which he received on the occasion. He was, however, patronized by sir Philip, who introduced him to his uncle, the favourite Leicester, who engaged him as an agent for his service in foreign countries, but it is uncertain whether he ever actually travelled abroad; at any rate he could not have been long in that employ, since, in 1580, he was attending lord Grey of Wilton, appointed lord-deputy of Ireland, as his secretary. In this situation he displayed those talents for business, which are usually, though often very unjustly, represented as incompatible with a poetic genius. He returned with lord Grey in 1582, and was probably some years an attendant at court, and in 1586 he had a grant from the crown of upwards of 3000 acres of land in the county of Cork, out of the vast forfeited property of the earl of Desmond. In 1587 Spenser went over to take possession of this estate; his residence was the castle of Kilcolman, near Doneraile, where, in the style of pastoral poetry, he describes himself as keeping his sheep "under the Mole, that mountain here," and frequenting the coolly shade of the green alders by the Mulla's shore. Here it appears he received a visit in 1589 from sir Walter Raleigh, who had been a commander in Ireland under lord Grey, and had obtained a large grant of land from the crown. Spenser celebrates him in a poem under the title of the "Shepherd of the Ocean," and highly extols his courtesy and elegant accomplishments. At this period Spenser was engaged in the composition of his "Faery Queen," of which he had written the three first books; and accompanying Raleigh the next year to England they were published, with a dedication to queen Elizabeth, and an introductory letter addressed to Raleigh, explaining the plan of the whole projected work. Elizabeth rewarded his poetry and dedication by a pension of 50*l. per annum*, granted in 1591, and he has been termed her laureat, though the title was not formally conferred upon him. Spenser returned to Ireland in 1591, and married a country lass of low degree, but the disturbances in that country forced him to return to England in 1595. Here he printed some poems, and drew up a plan for the entire reduction of that island in the space of two winters, which work he completed in the next year, giving it the title of "A View of the State of Ireland." This piece remained in MS. till it was printed in 1633 by sir James Ware, who bestows much applause on the information and judgment displayed in it, though he intimates, that it was deficient in moderation: and it is generally admitted, that in what he says concerning the history and antiquities of the country there are many errors, and the fanciful turn of a poet is more conspicuous than the sobriety of a judicious enquirer. In 1596 he published a new edition of his "Faery Queen," with additional books, which only completed half his original design. It was currently reported, that the remaining six books were lost by a servant, who was entrusted to carry them to England, which certainly would be one of the greatest disasters that a poet could possibly suffer, and might greatly contribute to break his spirits: the fact, however, is very questionable, and certainly does not stand on good authority: it is most probable that they were never finished. He returned to Kilcolman in 1597, but Tyrone having in the next year broken out in rebellion, and overrun the county of Cork, Spenser was obliged to take refuge with his wife in England, leaving all his property to the spoil and ravages of the insurgents.

His house was burnt, and with it, it is said, an infant who had not been removed. Reduced to a state of indigence, he sunk under his misfortunes in the same year, or in the beginning of the next. He was interred in Westminster Abbey, at the expence of the earl of Essex, several of his brother poets attending, and throwing into his grave copies of panegyric verses. A monument was afterwards erected to his memory by Anne, the celebrated countess of Dorset. Of his family and posterity nothing is known, except that one of his descendants was restored in the reign of Charles II. to so much of the estate in Ireland, as he could prove had belonged to his ancestor; and that another, or perhaps the same, came to England in the reign of William with a similar claim, which was allowed. The works of Spenser are animated with a fervent spirit of piety, and a pure and exalted morality; and though he certainly paid an assiduous court to the great, he was not guilty of that meanness of adulation, which was too much practised even by some eminent persons of that age. The homage paid to the queen was great, but it was deemed impossible to carry this too far.

The poetical reputation of Spenser is chiefly supported by his great work the "Faery Queen," for his pastorals will scarcely please a correct taste; and though critics admit that there is much occasional beauty of sentiment and harmony of versification in his sonnets, hymns, and other miscellaneous pieces, yet on the whole they are scarcely distinguished from the effusions of tedious pedantry common in that age. But the "Faery Queen" is justly regarded as one of the great compositions in English poetry, and has lost none of its value by antiquity. "If its plan is singularly involved, its allegories often defective and obscure, and its adventures extravagant, it is, however, absolutely unrivalled for the fertility of its conceptions, and the vividness of its painting. Its great length, and want of interest as a fable, deter readers, in general, from a complete perusal, but it will always be resorted to by the lovers of poetry as a rich storehouse of invention, especially of that kind which consists in the personification of moral ideas." Biog. Brit.

SPENT, at *Sea*. The seamen say a ship hath spent any malt or yard, when it is broken down by foul weather, or any such accident; but if it be done by an enemy's shot in a fight, they say, *such a yard, or mast, was shot by the board*.

SPERA, in *Geography*, a town of European Turkey, in Dobruzzi Tartary; 40 miles S. of Ismail.

SPERAGE, ASPARAGUS, in *Botany*. See ASPARAGUS.

SPERDILLEN, in *Geography*, a lake of Norway, in Aggerhuus, 32 miles long and 12 wide; 4 miles N. of Christiania.

SPERGULA, in *Botany*, a word which Dodonæus, who is cited as its author, expressly says was latinized from the name of this herb in Brabant, *Spuerie*, whence its English appellation, *Spurrey*. Whether σπερῆ, a modern Greek name for *Verbascum Blattaria*, has any common origin with this Flanders word, or whether both may allude to the copious dispersion of seeds in both cases, and have been derived from the ancient Greek σπερῆν, *to sow, or scatter*, we can only propose as a conjecture. Linnæus, however, seems to have had some such etymology in contemplation, when he, in Phil. Bot. p. 167, explains *Spergula* by "*a scattering of seed*;" though probably he looked no further than the Latin, *spargo*.—Linn. Gen. 232. Schreb. 312. Willd. Sp. Pl. v. 2. 818. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 502. Prodr. Fl. Græc. Sibth. v. 1. 317. Ait. Hort. Kew. v. 3. 137. Fusch v. 1. 320. Will. Gen. 131. t. 7. f. 3. Juss

SPERGULA.

Juss. 301. Lamarck Illustr. t. 392. Gærta. t. 130.—
Class and order, *Decandria Pentagynia*. Nat. Ord. *Caryophylleæ*, Linn. *Caryophylleæ*, Juss.

Gen. Ch. Cal. Perianth inferior, of five ovate, obtuse, concave, spreading, permanent leaves. Cor. Petals five, ovate, concave, spreading, undivided, larger than the calyx. Stam. Filaments ten, rarely but five, awl-shaped, shorter than the corolla; anthers roundish. Pist. Germen superior, ovate; styles five, somewhat reflexed, thread-shaped; stigmas thickish. Peric. Capsule ovate, covered partly by the calyx, of one cell, and five valves. Seeds numerous, globose, but depressed, furrowed with more or less of a notched or dilated border.

Eff. Ch. Calyx of five leaves. Petals five, undivided. Capsule superior, ovate, of one cell, with five valves.

Obf. Linnæus remarks, that this genus differs from *Cerastium* in having undivided petals. Their general habit also differs more than is the case with most genera of this natural order, that of *Spergula* nearly according with various *Arenaria*, from which the five styles only distinguish it. *S. pentandra* has but five stamens.

1. *S. arvensis*. Rough-seeded Corn Spurrey. Linn. Sp. Pl. 630. Willd. n. 1. Fl. Brit. n. 1. Engl. Bot. t. 1535. Curt. Lond. fasc. 5. t. 31. (Sagina spergula; Ger. Em. 1125.)—Leaves whorled. Stalks of the fruit reflexed. Seeds kidney-shaped, angular, rough.—Native of corn-fields and waste ground, on a sandy soil, throughout Europe, flowering from July to September. Root annual, small. Herb more or less downy and viscid, very various in luxuriance, somewhat succulent and brittle, with a branched, round, loosely spreading stem, whose joints are beset with copious, whorled, linear, obtuse leaves. Panicles terminal, forked, divaricated, level-topped. Flower-stalks downy; strongly reflexed, from the base, as the fruit ripens. Calyx membranous at the edge, nearly as long as the white petals. Stamens generally ten; sometimes five, or some intermediate number. Capsule almost twice as long as the calyx. Seeds numerous, kidney-shaped or roundish, swelling, angular, with an obsolete, not dilated nor membranous, border; when ripe they are black, and rough all over with minute tubercles or bristles. In Flanders, Germany, and the north of Europe, this herb serves as fodder, and poultry are fed with its seeds. With us it is a troublesome weed, on a light soil.

2. *S. pentandra*. Smooth-seeded Corn Spurrey. Linn. Sp. Pl. 630. Willd. n. 2. Engl. Bot. t. 1536. (*S. annua*, femine foliaco nigro, circulo membranaceo albo cineto; Dill. Giff. 46.)—Leaves whorled. Stalks of the fruit reflexed. Stamens five. Seeds lenticular, smooth, with a membranous border.—Native of Germany, England, and probably other parts of Europe, in sandy ground, flowering in July and August. Mr. Shepherd, curator of the botanic garden at Liverpool, first observed this plant about that neighbourhood, growing along with the preceding species, with which it altogether agrees in general appearance, but the flowers are perhaps rather smaller, and their stamens are rarely more than five in number. The most remarkable difference is found in the seeds, which are compressed and lenticular, always smooth, and bordered by a very conspicuous whitish membrane. Such is the difference likewise between *Arenaria marina* and *rubra*. We cannot but feel a mistrust of this character, however striking, considering the close resemblance between these two *Spergulae*, at least, in other respects. The plant found about Liverpool is certainly what Linnæus and Dillenius intended, and therefore the uncertainty expressed in *Fl. Brit.* respecting *S. pentandra*, is now removed.

3. *S. nodosa*. Knotted Spurrey. Linn. Sp. Pl. 630. Willd. n. 3. Fl. Brit. n. 3. Engl. Bot. t. 694. Curt. Lond. fasc. 4. t. 34. Fl. Dan. t. 96. (*Saxifraga palustris alpinefolia*; Ger. Em. 567.)—Leaves opposite, awl-shaped, smooth; the upper ones clustered. Calyx without ribs.—Native of wet sandy heaths and commons, in the colder countries of Europe, flowering in July and August, but not very common with us. Mr. Goodyer, an accurate and ingenious contributor to the second edition of Gerarde's Herbal, first detected this species in England. Its habit is that of an *Arenaria*, especially the pure white flowers. The fibrous perennial root produces several spreading or prostrate stems, three or four inches long, slightly branched, beset with many pairs of awl-shaped, short, smooth, dark-green leaves, accompanied by axillary tufts of smaller ones, giving the herb a knotty or jointed aspect. Flowers large, stalked, about the extremities of the stems. Styles five, as well as the valves of the capsule, by which alone this plant is separated from *Arenaria*.

4. *S. laricina*. Larch-leaved Spurrey. Linn. Sp. Pl. 631. Willd. n. 4. Sm. Plant. Ic. t. 18. (Alfina n. 61; Gmel. Sib. v. 4. 155.)—Leaves opposite, awl-shaped, fringed, clustered.—A rare species, found by Steller in Siberia. It differs from the last in being somewhat larger, with longer, acute leaves, fringed at the base. English botanists had been accustomed to consider the following as the true *S. laricina*, till the Linnæan herbarium taught them to correct this error.

5. *S. faginoides*. Smooth Awl-shaped Spurrey. Linn. Sp. Pl. 631. Willd. n. 5. Fl. Brit. n. 4. Engl. Bot. t. 2105. (Alfina n. 64; Gmel. Sib. v. 4. 157.)—Leaves opposite, awl-shaped, pointless, naked. Flower-stalks solitary, very long, smooth.—A rare inhabitant of the Scottish highland mountains, flowering in June. Gmelin found it in Siberia. The perennial fibrous root resembles that of *S. nodosa*, but the herb is smaller, more branched and erect, without any axillary clusters of leaves, and having more resemblance to a *Sagina* than an *Arenaria*. Every part is quite smooth, by which, and the want of a bristly point to the leaves, this *Spergula* essentially and constantly differs from the more common one next described. The flowers are terminal, rather drooping, on long, solitary stalks. Petals white, roundish, hardly so long as the calyx. Stamens ten. Professor Swartz describes but five, which makes us doubtful of his plant. Seeds kidney-shaped, without any edge or border.

6. *S. subulata*. Ciliated Awl-shaped Spurrey. Swartz in Stockh. Transf. for 1789, 45. t. 1. f. 3. Willd. n. 6. Fl. Brit. n. 5. Engl. Bot. t. 1082. (*S. laricina*; Hudf. 203. Fl. Dan. t. 858. *S. faginoides*; Curt. Lond. fasc. 4. t. 35. *Sagina procumbens* β ; Linn. Sp. Pl. 185.)—Leaves opposite, awl-shaped, fringed, tipped with a bristly point. Flower-stalks solitary, very long, somewhat hairy.—Native of sandy barren heaths in the north of Europe, flowering with us from June to August. It is perennial, and resembles the last in general habit, but the leaves are constantly fringed with glandular hairs, and tipped with a bristly point. The flowers too are smaller, with generally hairy glutinous stalks, and usually but five stamens. Seeds small, compressed, pale brown, encircled with a black line, but no dilated border.

7. *S. glabra*. Smooth Capillary Spurrey. Willd. n. 7. (*S. faginoides*; Allion. Pedem. v. 2. 118. t. 64. f. 1, excluding the synonyms.)—Leaves opposite, thread-shaped, smooth, clustered. Flower-stalks solitary, very long, smooth.—Common in the grassy alpine pastures of Savoy, according to Allioni, by whose work alone we have any knowledge

of this plant. It vies in magnitude with *S. laricina*, but is much more slender in the *foliage*, as well as quite smooth. *Petals* white, twice as long as the *calyx*. *Stamens* ten.

SPERGULASTRUM, (so called from its resemblance to *Spergula*), a genus of Michaux, *Flora Boreali-Americana*, v. 1. 275. The author speaks of it as a doubtful genus, differing from *Spergula* chiefly in having but four *stigmas*, or rather *styles*, which in one species vary to three. Perfoon and Pursh have published this genus under the appellation of *Micropetalum*, the original name being equally contrary to sense and usage, because it is formed of another established one, merely varied in termination.

SPERJLEN, in *Geography*, a lake of Norway, in Aggerhus; 35 miles N. of Christiania.

SPERLING, OTTO, in *Biography*, son of a person of the same name, was born at Christiania, in Norway, in 1634. He received the early part of his education at Copenhagen; he afterwards studied at the gymnasium of Bordeholm, and then at the academy of Helmstadt. In 1655 he became private tutor to the son of M. Wrangel, governor of Swedish Pomerania, and in 1658 made a tour to Holland, France, and England. In 1662 he went to Hamburg, as tutor to the youngest son of Corfits Ulfeld, and in 1674 took the degree of doctor of laws at Kiel. In 1681 he travelled with the sons of J. A. Von Bachwald, and spent some time at Paris, where he was employed in arranging the library of the celebrated Colbert, for which service he received a pension of 200 rix-dollars as long as that noble-minded man lived. On his return he proceeded to Hamburg, where he practised the law: he was afterwards assessor in the court of Gluckstadt, and in 1690 he was invited to Copenhagen, where he was employed in various important affairs. In 1692 he was elected professor of jurisprudence and history, and afterwards of oratory and history, in the new knights' academy at Copenhagen. In 1698 he obtained leave to resign, on account of his age, but in 1701 he resumed his former station as professor of history and oratory, in which he continued till the suppression of the academy in 1710. He became a member of the Royal Society of London in 1700, and died in 1715. He was author of a great many works, among which were the following: "Monumentum Hamburgense Benedictinum;" "De Danicæ Linguæ ac Nominis antiqua Gloria et Prærogativa inter Septentrionales," &c. Gen. Biog.

SPERLING, in *Geography*, a town of Prussia, in the province of Natangen; 15 miles E. of Angerburg.

SPERLINGA, a town of Sicily, in the valley of Demona; 10 miles S. of Mistretta.

SPERLONGA, a town of Naples, in Lavora; 7 miles S. of Fundi.

SPERM, *СПЕРМА*, *σπερμα*, the seed of which an animal is formed.

SPERMACETI, or **PARMASITTY**, in *Pharmacy*, is a whitish, flaky, unctuous substance, prepared from oil; principally from that of a cetaceous fish, called by some the *male whale*, by others *cachalot*, and by the Latins *orga*; distinguished from the common whale by its having teeth in lieu of whale-bone, and by a bunch on its back. See **PHYSETER**.

The ancients were strangers to the nature of this preparation; and even Schroder seems in doubt, whether to reckon it an animal or mineral substance.

It had its name *spermaceti*, seed or sperm of whale, given it, no doubt, to raise its value, by a notion of its scarcity. The spongy oily mass from which it is made, is found in a large triangular trunk, four or five feet deep, and ten or twelve long, filling almost the whole cavity of the head, and seeming to be entirely different from the proper brain of the

animal. The oil is separated from it by dripping. In this state it has a yellow unctuous appearance, and is brought to England in barrels. An ordinary sized whale, it is said, will yield upwards of twelve large barrels of crude spermaceti. The mode of purifying it in the large way is as follows: the mass is put into hair or woollen bags, and pressed between plates of iron in a screw-press, until it becomes hard and brittle. It is then broken in pieces, and thrown into boiling water, where it melts, and the impurities, which rise to the surface or sink to the bottom, are skimmed off or separated from it. After being cooled, and separated from the water, it is put into fresh water in a large boiler, and a weak ley of the potash of commerce added to it by degrees. This part of the process is thrice repeated, after which the whole is poured into coolers, when the spermaceti concretes into a white semitransparent mass, which, on being cut into small pieces, assumes the flaky appearance which it has in the shops. Some of our druggists, it is said, possess the art of making it from the sediment or fæces of any kind of oil.

Some sophisticate it with wax; but the deceit is discovered, either by the smell of the wax, or by the dulness of the colour. Some also sell a preparation of oil gained from the tail of the whale, instead of that from the brain; which last kind turns yellow, as soon as opened to the air. In the general, there is no merchandize that should be kept closer from the air than spermaceti.

Purified spermaceti is an almost silvery white, friable, semitransparent, unctuous substance, inodorous and insipid, or having very little flavour, and only a slight tallowy odour. It is softer and more brittle than white wax; and it is distinguished from every other species of concrete oil, by its superior transparency, high lustre, and crystalline texture. Its specific gravity is 9.433, and it melts at 112° Fahr.; and at a higher temperature evaporates, with little alteration. By the assistance of a wick, it burns with a clear white flame, superior to that of tallow, and without any disagreeable odour; and this constitutes its excellence as a material for candles. By repeated distillation, the spermaceti becomes permanently fluid at the common temperature. According to the experiments of Crell, its distillation requires a greater heat than fat; and the coagulated oil, thus procured, partly white and partly brownish. By repeated distillation it affords a yellowish acid, and becomes more fluid, but coagulates in the cold. The acid, rectified by distillation, is entirely colourless, and affords the same salts with earths and alkalies as Crell's subacetic acid. The oil unites with ammonia into a saponaceous emulsion. It may be diffused in water by means of the yolk of egg or mucilage. It is sparingly soluble in boiling alcohol, 150 parts of the menstruum being necessary for this purpose; and as the solution cools, the spermaceti is again precipitated. Pure ether very copiously dissolves it, but seems to retain none of it when cold. Oil of turpentine has the same effect. With caustic potash it combines into a soap, soluble in warm water. Fluid ammonia, when cold, has no action upon it; but when warm, very easily dissolves it, forming an emulsion, which is not decomposed either by simple cooling, or by mixture with water; but the addition of an acid instantly precipitates the spermaceti. With concentrated sulphuric acid it forms a brownish solution, which, dropped into water, gives up its spermaceti, apparently unaltered. Like the other fat oils, it dissolves sulphur. By long exposure to the air, it acquires a yellow tinge, and becomes rancid; but it may be again purified, by being washed in a warm ley of potash. The great use of spermaceti is for making candles; and it is also employed in medicine.

Spermaceti candles are of modern manufacture: they are

made smooth, with a fine gloss, free from rings and scars, superior to the finest wax candles in colour and lustre; and, when genuine, leave no spot or stain on the finest silk, cloth, or linen.

In medicine, spermaceti is demulcent and emollient; but for internal use it possesses no advantages superior to those of the bland oils. It is used in dysentery and irritations of the alimentary canal, and also in catarrh and phtisis; but in the latter cases it is less beneficial than the bland oils. Some imaginary virtues have been ascribed to spermaceti, which have occasioned the use of it by women in child-bed. In its combination with water by means of the yolk of egg, it is a pleasant vehicle for opium, when the after-pains are troublesome. It forms a part of the composition of several ointments. The dose is from ʒss to ʒjss, rubbed with sugar, or in the form of emulsion. It possesses a property, which is that of softening the skin, which has occasioned its being used by the ladies in pastes, washes, &c. Its official preparations are the "ceratum simplex" of the Edinb. Ph., formed of six parts of olive oil, three parts of white wax, and one part of spermaceti; the "ceratum cetacei" of the Lond. Ph. (see CERATUM); the "unguentum cetacei," or spermaceti ointment, of the Lond. Ph., formed by melting together, over a slow fire, six drachms of spermaceti and two drachms of white wax, and stirring them constantly till they be cold; and the "unguentum spermatis ceti," or ointment of spermaceti, of the Dubl. Ph., formed by making half a pound of white wax, one pound of spermaceti, and three pounds of prepared lard, into an ointment. These ointments constitute the ordinary dressings for blistered surfaces and excoriations.

SPERMACOCE, in *Botany*, so named by Dillenius, in his *Hortus Elthamensis* 369, from *σπίγμα*, seed, and *ακων*, a sharp point, in allusion to the little erect beaks of the capsules.—Linn. Gen. 50. Schreb. 66. Willd. Sp. Pl. v. 1. 568. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 1. 232. Pursh 105. Juss. 197. Lamarek Illustr. t. 62. Gærtn. t. 25.—Class and order, *Tetrandria Monogynia*. Nat. Ord. *Stellatae*, Linn. *Rubiaceae*, Juss.

Gen. Ch. *Cal.* Perianth small, superior, with four teeth, permanent. *Cor.* of one petal, funnel-shaped; tube cylindrical, slender, longer than the calyx; limb in four deep, obtuse, widely spreading, somewhat reflexed segments. *Stam.* Filaments four, awl-shaped, shorter than the corolla; anthers simple. *Pistl.* Germen inferior, roundish, compressed; style simple, divided in the upper part; stigmas obtuse. *Peric.* Capsules two, combined, oblong, gibbous externally, flat on the inner side, obtuse, each with two beaks. *Seeds* solitary, roundish, rolled in at the edges.

Ess. Ch. Corolla of one petal, funnel-shaped. Capsules two, combined, each crowned with two teeth.

A genus of extra-European weeds, not recommended by any beauty of aspect, or known utility, chiefly the produce of the West Indies, or the warmer parts of North America, a few species only being found in the East Indies. The plants are generally herbaceous, in many instances annual, often rough, with opposite, simple, entire leaves; sheathing, membranous, jagged or bristly, stipulas, like many of the same natural order; and numerous, small, white, reddish, or blueish, whorled or capitate, flowers.

Eight species are enumerated in Linn. *Syst. Veg.* ed. 14, of which the seventh, *S. procumbens*, is the same as *Hedyotis fruticosa* of Linnæus. Willdenow has twenty species, to which three new ones are added by Pursh. Five find a place in the *Hortus Kewensis*. We shall select a few examples, sufficient to give a general idea of the whole.

S. tenuior. Slender Button-weed. Linn. Sp. Pl. 147. Willd. n. 1. Ait. n. 1. (*S. verticillis tenuioribus*; Dill. Elth. 370. t. 277. f. 359.)—Stem smooth, erect. Leaves lanceolate; rough on the upper side. Flowers whorled. Stamens shorter than the corolla. Fruit hairy.—Native of the West Indies. Found also, according to Pursh, in dry gravelly situations, from Virginia to Carolina, flowering from June to August. Root annual. Stem square. Leaves an inch and a half long, lanceolate, acute. Flowers very small, white.

S. glabra. Smooth Button-weed. Michaux Boreal-Amer. v. 1. 82. Pursh n. 2.—Stem smooth, procumbent. Leaves ovato-lanceolate, smooth on both sides. Flowers whorled. Fruit smooth.—On the banks of rivers in most of the western territories of North America, flowering in July and August. The plant is annual. Flowers white, longer than in the former.

S. verticillata. Dense-whorled Button-weed. Linn. Sp. Pl. 148. Willd. n. 9. Ait. n. 4. (*S. verticillis globosis*; Dill. Elth. 369. t. 277. f. 358.)—Hairy. Leaves lanceolate. Whorls globose, many-flowered.—Native of Africa. Cultivated by Sherard. The stem is shrubby, erect, branched, with numerous, narrow, somewhat clustered leaves, and dense whorls of small, white, very copious flowers. Such is the Senegal plant, described by Dillenius. The Jamaica specimen from Brown, which is smooth, and which led Linnæus to admit that circumstance into his specific definition, may possibly be a different species, but we have not sufficient materials to decide this point. Swartz speaks of this last as having, when in flower, the smell of Melilot.

S. hirta. Rough Hairy Button-weed. Linn. Sp. Pl. 148. Willd. n. 12. Swartz Obf. 45. (*S. n. 3*; Browne Jam. 141.)—Stem branched, hairy. Leaves ovato-lanceolate, rough with callous points. Flowers axillary, crowded, sessile. Stamens prominent.—Native of dry grassy places in the West Indies. Root annual. Angles of the stems rough with recurved bristly hairs. Leaves stalked, an inch and a half or two inches long, rough like a file, especially on the upper side. Stipulas fringed with long taper bristles. Flowers small, whitish, with blue anthers. Fruit hairy.

S. villosa. Shaggy Button-weed. Swartz Prodr. 29. Ind. Occ. 1943. Willd. n. 13. (*Pulegium fruticosum erectum, verticillis densissimis*; Sloane Jam. v. 1. 170.)—"Stem shaggy, slightly branched. Leaves ovato-lanceolate, downy; the uppermost four together. Flowers whorled. Stamens shorter than the corolla."—Native of fields and meadows, in the southern part of Jamaica, flowering all the year round. The stem is herbaceous, a foot high, but little branched, square, clothed with soft hairs. Leaves obtuse, with bristly ribs. Flowers white, with whitish, nearly sessile, anthers. Swartz.

S. procumbens. Procumbent Corymbose Button-weed. Linn. *Syst. Nat.* ed. 12. v. 2. 115. Willd. n. 19. (*S. corymbosa*; Linn. Sp. Pl. 149.)—Stem procumbent. Leaves linear-lanceolate, entire, smooth-edged. Corymbs lateral, stalked, many-flowered.—Native of the East or West Indies. Of this we have seen only an imperfect specimen, in the Linnæan herbarium, which we should rather guess to belong to *Hedyotis*, but the fruit is not in a state to decide that question. The leaves are an inch long. Flowers in roundish corymbose heads, composed of crowded leafy whorls, on axillary compressed stalks. Calyx recurved, downy. Corolla hairy within. Stamens prominent.

S. hypsipifolia. Hyssop-leaved Button-weed. Sm. Inf. of Georgia, v. 1. 75. t. 38.—Stem decumbent. Leaves linear-

linear-lanceolate, fringed with bristly teeth. Whorls of few flowers.—Native of Surinam and Georgia. A specimen was sent by Rolander to Linnæus, who marked it *S. strigosa*, but afterwards effaced that name, nor does this species seem to have been any where described, till it appeared in the Natural History of the Insects of Georgia, with the plants on which they feed, published by the writer of this article, from the drawings and papers of Mr. John Abbot. This work is never cited by Willdenow, nor perhaps had it fallen in his way. The species before us has woody, wavy, decumbent, slightly branched, smoothish stems. The leaves are an inch long, remarkable for being bordered with fine cartilaginous teeth, pointing forward, like those of many species of *Galium*. Bristles of the *stipulas* numerous, long, and stout. *Flowers* reddish, three or four in each whorl. *Calyx* fringed. *Fruit* obovate, roughish, red even in an early state, though the *calyx* is green. We should suspect this to be the *S. diodina* of Michaux and Pursh, found in dry barren soils, on iron ore hills, from Virginia to Carolina, but the *flowers* of that species are described as white, and very small, solitary and alternate, the *stem* and *seeds* hairy, which characters do not answer to our plant, though the edges of the *leaves* appear to be similarly rough in both.

S. involucreta. Long-flowered Button-weed. Pursh n. 4.—“Stem alternately branched, very hispid. Leaves ovato-lanceolate, pointed, hairy on both sides. Stipulas with many bristles. Heads terminal, bracteate. Stamens prominent.”—Found in Carolina by Mr. Frazer. About a foot high. *Leaves* broad, rather oblique. *Flowers* white, with a very long tube.

SPERMACEOE, in *Gardening*, contains plants of the herbaceous, annual, and shrubby kinds; among which the species cultivated are, the slender button-weed (*S. tenuior*); and the whorl-flowered button-weed (*S. verticillata*).

Method of Culture.—These plants are increased by sowing the seeds on a moderate hot-bed, early in the spring, or in pots to be plunged in it. When the plants have attained some growth, they should be removed into separate pots, filled with good friable mould, replunging them in the bed. They should afterwards be managed as other plants of the exotic stove kind.

They afford variety in hot-house and stove collections.

SPERMATIC, in *Anatomy*, an epithet applied to various parts belonging to the testicle, as the artery, veins, nerves, cord, &c. See the description of the testis in the article GENERATION.

SPERMATIC Chord, *Disease of*, in *Surgery*. See HYDROCELE.

SPERMATOCELE, a kind of rupture, occasioned by a distension of the femal vessels, by which they are let fall into the scrotum.

SPERMATOPŒA, a name given to such medicines as are supposed to increase the semen.

SPERMATOSIS is a term sometimes used for the formation of seed.

SPERONE, LA, in *Geography*, a cape at the south-east extremity of Corsica; 4 miles E. of Bonifacio.

SPERONI, SPERONE, in *Biography*, a distinguished Italian writer of the 16th century, was the son of Bernardino Speroni, a noble of Padua, in which city he was born in the year 1500. He studied under the famous Pomponazzo, in Bologna. He took his degrees in medicine and philosophy, and was appointed at an early age reader in logic, and professor of philosophy, in the university; but being greatly attached to his former preceptor Pomponazzo, he returned to Bologna, which he did not

quit till the death of that eminent man. He then resumed the professor's chair at Padua, which he held till the death of his father in 1528, and his own marriage. After this he was employed by his fellow-citizens in public business, and was entrusted with several honourable commissions. But he was not less intent upon literature than diligent in active business, and became one of the most learned men of his time. When residing as an envoy at Venice, his speeches before the senate were so much admired, that it has been affirmed, that the judges and advocates belonging to other courts would leave their own places, to hear his pleadings. Nevertheless he was not a lawyer by profession, but only took up, occasionally, the causes of his friends. In 1560 Speroni went to Rome, as agent to the duke of Urbino at the Papal court. He obtained the friendship of the principal men of letters at that capital, and was on terms of particular intimacy with Charles Borromeo; and on that account he was induced to add theology to his other studies. Pius IV. conferred on him the honour of knighthood; and the dukes of Urbino and Ferrara sent for him to their different courts, where he was treated with the greatest respect. Almost all the princes of Italy followed the example of those sovereigns, intreating him to take up his abode with them; but he preferred the tranquillity of private life to the honours that might have been showered upon him. He died at the great age of 88, and was interred with every kind of funeral honour. As a writer, his style is spoken of with singular approbation: it is said to be entirely free from the affected elegance and the prolixity which characterize many authors of that country and period. It rather seems purposely to shun the most ornamented expressions, and yet it is inferior to none in true polish, and unites gravity and precision to harmony and eloquence. One of the most celebrated compositions of Speroni was a tragedy, entitled “*Canace and Macareus*,” which was much applauded by the Paduan academy degli Inflammati. Some copies of it having got abroad without the knowledge of the author, an incorrect edition was printed at Venice in 1546, but with the imprint Florence. Before, however, this surreptitious publication, there appeared in MS. a criticism upon it, in which it was treated with singular severity. This being afterwards printed, Speroni thought it necessary to defend his composition, and a long controversy ensued. The author, no doubt, improved his work before he gave it to the public, sanctioned by his own authority; and when it thus appeared, it was regarded as one of the best productions of that class which the age exhibited. Of the other writings of that author, many are moral treatises in the form of dialogue, in which he was one of the first composers in Italian, and in which he is said to have had few equals. The rest related to polite literature, eloquence, poetry, history, &c.; all displaying an extensive knowledge of books, and a correct judgment. His works have been collected and published at Venice, in 5 vols. 4to.

SPERVERIUS, in *Ornithology*, a name by which Belonius, and some other authors, have called the sparrow-hawk, more commonly known by the names of *nifus*, and *accipiter fringillarius*.

SPESSART, in *Geography*, a large forest of Germany, to the right of the Mayne, extending from Wurzburg to Aschaffenburg.

SPETKER, a river of Switzerland, belonging to the abbey of St. Gal; 4 miles E. of St. Gal.

SPEUSIPPUS, in *Biography*, an Athenian philosopher, son of Eurymedon, by a sister of Plato, succeeded his uncle in his school, over which he presided during eight years, commencing from the death of that illustrious philosopher,

in the year B. C. 348. He placed the statues of the Graces in the school built by Plato in the academy, and closely adhered to the doctrines of his master. His manners, however, were not conformable to his philosophy: he was vindictive, and a lover of pleasure. He was likewise avaricious, and, contrary to the practice of Plato, exacted a gratuity from his disciples. He was admitted to the friendship of Dion while he resided at Athens; and it was by his instigation that Dion, invited by the malecontents of Syracuse, undertook his expedition against Dionysius. (See Dion. in Vit. Corn. Nep.) Becoming paralytic in his limbs, he was conveyed to and from the academy in a carriage of some kind. Upon one of these occasions he met Diogenes, and saluted him; but the cynic, instead of returning the civility, upbraided him for enduring to live under such an infirmity. To which Speusippus replied, "that he did not live in his limbs, but in his mind." At length, overcome by his maladies, and wearied of life, he put an end to his existence, having first constituted Xenocrates his successor in the academy. He was author of several philosophical treatises, which have perished; though it is said that they were held in such estimation by Aristotle, that he gave three talents for them.

SPEY, in *Geography*, a river of Scotland, which rises in the loch of that name, about eight miles S.W. from Fort Augustus, in the county of Inverness, and runs into the North sea, in the frith of Murray; 3 miles N.W. of Fochabers. N. lat. 57° 40'. W. long. 2° 59'.

SPEYERSBERG, a town of Bavaria, in the bishopric of Bamberg; 11 miles N. of Bamberg.

SPEYMOUTH, a parish of the shire of Elgin, Scotland, 1½ mile N.W. from Fochabers.

SPEZZA, or SPETIA, a sea-port town of the Ligurian republic, situated on a gulf of the Adriatic, to which it gives name, and anciently called "Portus Lunæ." At the entrance of the gulf is a small island, called "Palmaria," which makes the harbour safe and large; 35 miles S.E. of Genoa. N. lat. 44° 9'. E. long. 9° 40'.

SPEZZANO, a town of Italy, in the department of the Panaro; 5 miles S. of Modena.—Also, a town of Naples, in Calabria Citra; 4 miles E.N.E. of Cosenza.

SPHACELUS, from σφάζω, *to destroy*, implies, in *Surgery*, the complete mortification of a part of the body. See GANGRENE.

SPHACHIA, in *Geography*, a district or province of the island of Crete, lying towards the south, and extending to the east much more than Cidonia, or Kidonia, which is situated to the north; it is considered as making part of the pachalic of Candia; though the interior police and administration belong to the inhabitants themselves, called "Sphachiots." The first chain of the high mountains of Sphachia, comprised in the province of Kidonia, is covered with snow for four or five months. It is, in general, stony and destitute of earth; but it has a few narrow vallies which are susceptible of culture. Barley is sown here in May, and gathered in September. As soon as the snow is melted, the flocks are brought to these mountains; and though the ground appears almost naked, cattle find a food, which, if not abundant, is very relishing, and very fit for giving to their milk and flesh a quality, unattainable by those that are bred in the most fertile places. The Sphachiots inhabit the high mountains, which extend from E. to W., from the province of Selino, as far as that of Amari. Independently of a great number of villages, which are situated on these mountains, some are found towards the south coast, and among others "Sphachia," their chief place, which is a small harbour that contains

seven or eight large boats, which the Sphachiots use for their trade, and sometimes also for the piracies which they practise in imitation of their ancestors. The Maltese formerly frequented this harbour, and were furnished by the inhabitants with provisions, and all the assistance which they wanted. Sphachia produces scarcely any oil; but it affords a small quantity of wheat, and barley in greater abundance: it also furnishes honey and wax. The principal production consists in little cheeses made with ewes' milk, which are exported to Constantinople. In winter the Sphachiots drive their flocks to the sea-side, in order to obtain plenty of grass; but in summer they remove them back to feed on the rich pastures, which the milder temperature and gradual melting of the snow always maintain in a state of verdure. With the wine which these Greeks make on the first link of the chain of their mountains, they indulge themselves so freely, that they consume their whole stock during the three or four months that succeed the vintage, and in the remainder of the year they are obliged to drink pure water. The inhabitants of the Sphachian mountains are distinguished by their industry and activity; they are shepherds, agriculturists, and artisans; they occupy their land to advantage, and breed a great number of cattle; and manufacture with tolerable skill the cloths which they use, as well as the utensils and implements which they employ. Upon the whole, the Sphachiots have preserved the energy of the independent man, and the activity of a person who enjoys, without molestation, the fruit of his labour.

The Sphachiots, who are considered as the real descendants of those famous Cretans who were so long masters of the country, are distinguished from the other Greeks by their tall stature, their comely appearance, their love of liberty, their courage, their skill, and, above all, the hatred which they have vowed against the usurpers of this island. Under the Romans, the Saracens, the Venetians, and the Turks, the Sphachiots found means to preserve their laws and their customs. They annually appointed their magistrates in the general assemblies of the people. Obligated by the Turks to transport, in summer, from the top of their mountains, the ice necessary for the consumption of the inhabitants of Canea and Retimo, they paid no tax, no impost; they had no agas; they never saw among them the agents of the Turkish government; they formed, in a word, a republic in some measure independent. When, in 1769, some Russian emissaries came to disturb the peace, and impair the happiness, which these privileged Greeks enjoyed on their mountains, the Sphachiots recurred to arms; and some hundreds of the bravest of them went and joined the Mainots, their friends, and proceeded together to offer their services to count Orloff, at a time when they apprehended the Russians were preparing to deliver the Greeks from the Ottoman yoke. The pasha of Candia, informed of the conduct of the Sphachiots, resolved, in the same year 1770, to march against them with all the forces of the island. He wished to exterminate them, and thus to afford a terrible example of severity to all the Greeks who might be tempted to imitate them. The Turks soon united under their colours. The Sphachiots, taking advantage of their rocks and mountains, defended themselves against the attacks of the Turks, and sheltered themselves amidst their crags and precipices. Notwithstanding their resistance, the Turks persevered, though tired of a painful and disagreeable war, and loudly demanding to return home, reduced the Sphachiots to the last extremity. Almost all their villages were set on fire; many of their women and children were carried off, as well as their flocks,

flocks, and their provisions were exhausted. In these circumstances they received with pleasure the first proposals that were made to them, consented to pay their annual tribute, and obtained permission to return to their habitations, and continue their barter with the maritime towns. The Turks treated them in the most insulting and cruel manner, loading 3000 or 4000 Greeks with their baggage, and in their different battles placing them in front, so as to make a rampart of their bodies. This cowardly and barbarous treatment greatly distressed these brave mountaineers; and frequently prevented their firing on their enemies, for fear of injuring those whom they considered as their brethren, still more unfortunate than themselves. Although the Sphachiots pay their karatch with the greatest repugnance, and are disposed to avail themselves of the first favourable moment for shaking off the yoke, which hangs heavy on their necks, they took care, during the last war of the Russians against the Turks, to resist the solicitations addressed to them for taking a part in any hostile armaments. By this wary conduct, they have preserved the few privileges which they have remaining. Olivier's Travels.

SPHÆCULÆ, among the Romans, were tickets of wood, *tefferæ ligneæ*, by which the emperors scattered their presents to people of both sexes in the theatre, or circus.

SPHÆRANTHUS, in Botany, derived from *σφαῖρα*, a sphere, or globe, and *ανθος*, a flower, from the aggregation of its florets into globular heads.—Linn. Gen. 452. Schreb. 591. Willd. Sp. Pl. v. 3. 2394. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 5. 184. Juss. 176. Lamarck Dict. v. 7. 321. Illustr. t. 718. Gært. t. 164. Loureir. Cochinch. 509. Vaill. Mem. de l'Acad. des Sc. 1719. t. 20. f. 12.—Class and order, *Syngenesia Polygamia Segregata*. Nat. Ord. *Compositæ Capitata*, Linn. *Cinacrocephala*, Juss.

Gen. Ch. Common Calyx globular, imbricated with pointed, permanent scales, clothing the general receptacle on all sides; partial one to each scale of the common calyx, many-flowered, of five linear, equal, erect leaves. Cor. partial comprising about three perfect florets in the disk, and mostly five female ones in the radius. Perfect florets of one petal, funnel-shaped, with a five-cleft, spreading limb; female awl-shaped, tubular, with a trifid, very small, closed mouth. Stam. (in the perfect florets) Filaments five, capillary, very short; anthers cylindrical, tubular, longer than the corolla. Pist. (in the perfect florets) Germen shrivelled; style long and rather thick; stigma quite simple: (in the female florets) Germen oblong; style setaceous, the length of the stamens; stigma cloven. Peric. none, except the unchanged calyx. Seeds (in the perfect florets) none; (in the female) solitary, oblong, naked. Recept. common scaly; partial naked.

Ess. Ch. Partial calyx eight-flowered. Florets tubular, perfect; some imperfectly female. Receptacle scaly. Down none.

1. *S. indicus*. Indian Sphæranthus. Linn. Sp. Pl. 1314. Fl. Zeylan. 312. Willd. n. 1. (*S. purpurea alata ferrata*; Burman. Zeylan. 220. t. 94. f. 3.)—Leaves lanceolate, serrated, decurrent, smooth. Peduncles winged. Wings of the stem and stalks serrated.—Native of the East Indies. It flowers at Kew, in the stove, from August to December. Root perennial. Stems herbaceous, branched above and below, smooth. Leaves alternate, sessile, lanceolate, naked, serrated, remarkably decurrent, involute, having the fragrance of oil of lavender. Flowers solitary, terminal, globular, of a blue or purplish colour.

2. *S. microcephalus*. Small-headed Sphæranthus. Willd. n. 2.—Leaves obovato-lanceolate, slightly pointed, serrated,

decurrent, smooth. Peduncles winged. Wings of the stem and stalks entire.—Native of Java.—Willdenow, upon whose authority this and the following species are adopted, says, that this is very like the preceding, but that its wings are entire, not serrated. Leaves obovato-lanceolate, obtuse, with minute, very distant, pointed serratures. Flowers in oblong, not spherical, heads, about half as big as those of the last species.

3. *S. hirtus*. Hairy Sphæranthus. Willd. n. 3. Lamarck Illustr. t. 718. f. 1.—Leaves obovate, serrated, hairy, decurrent. Peduncles winged.—Allied to the first species, but distinct in having obovate leaves, and smaller heads of flowers, as well as in the hairiness of all its parts.

4. *S. africanus*. African Sphæranthus. Linn. Sp. Pl. 1314. Thunb. Prodr. 169. (*Scabiosa minor, alata caule, maderaspatensis*; Pluk. Alm. 335. t. 108. f. 7.)—Leaves decurrent, ovate, serrated. Peduncles round.—Native of the Cape of Good Hope and Madras, flowering at Kew in July and August. Stem herbaceous, about ten inches high. Leaves alternate, ovate-lanceolate. Peduncles sustaining three or four globular heads of flowers of a pale yellow colour.

5. *S. chinensis*. Linn. Mant. 119. Willd. n. 5.—Leaves sessile, pinnatifid.—Native of India. Why then (says professor Martyn) is it named *chinensis*?—It is extremely like *S. indicus*, but a much smaller plant, with pinnate, sinuated leaves, and, if we mistake not, is the very same as the Linnean *Artemisia maderaspatana*.

6. *S. cochinchinensis*. Loureir. Cochinch. 510.—Leaves decurrent, oblong, undivided. Flowers in heart-shaped, ovate, nearly sessile, terminal heads.—Native of China and Cochinchina, among corn, and in gardens.—Stem herbaceous, a foot and half high, erect, round, smooth, whitish, with a few ascending branches. Leaves alternate, sessile, undulated, rugose, woolly. Flowers white, tinged with a little purple. Loureiro observes, that the last species (*S. chinensis*) differs from this only in having pinnatifid leaves.

SPHÆRIA, a genus of the fungus tribe, defined by Micheli, but properly named by Haller, in allusion to the spherical shape of the seed-vessels.—Hall. Hist. v. 2. 120. Schreb. Gen. 770. Perf. Syn. 1. Lamarck t. 879. (*Lichen-agaricus*; Mich. Gen. 103. t. 54, 55.)—Class and order, *Cryptogamia Fungi*. Nat. Ord. *Fungi, angiocarpi*.

Ess. Ch. Capsules roundish, immersed, filled with jelly, which becomes a mass of minute, volatile, seeds.

Perfoon reckons up 184 species, distributed in eight sections, of each of which we shall exhibit examples.

Sect. 1. *Caulescent, elongated or club-shaped; their substance either fleshy or corky*. Ten species.

S. militaris. Scarlet Club-shaped Sphæria. Perf. n. 1. Obs. Mycolog. fasc. 2. 66. t. 6. f. 3. Sowerb. Fung. t. 60. (*Clavaria militaris*; Linn. Sp. Pl. 1652. Hudf. 638. With. v. 4. 361? *C. militaris crocea*; Vaill. Paris. 39. t. 7. f. 4. *C. granulosa*; Bulliard t. 496. f. 1.)—Tawny red, or scarlet, fleshy, club-shaped. Head granulated with the prominent seed-vessels. Perfoon mentions this as found in autumn, after great rains, in wet grassy places, always growing out of some dead caterpillar or chrysalis. The only specimen we ever saw was gathered on a dry gravelly bank above Thorpe, near Norwich, and measured about an inch in height, the head being ovate, of a beautiful scarlet, granulated like orange-peel; the stalk paler and smooth. The figures above cited are rather taller, and generally more yellowish. Withering appears to confound various distinct species under the above name.

S. cutomorphiza. Slender-stalked Sphæria. Dickf. Crypt. fasc.

fasc. 1. 22. t. 3. f. 3. Perf. n. 4. With. v. 4. 389.—Stalk elongated, slender, simple or divided, somewhat compressed. Head roundish, brown.—Found by the late Rev. Mr. Lightfoot, in the woods of the duchess dowager of Portland at Bulltrode, in autumn, but rarely, growing out of some dead insect. The *stalk* was usually two or three inches high, wavy, slender, blackish; sometimes deeply cloven. *Heads* solitary, globular, granulated, brownish, the size of a small pea.

S. ophioglossoides. Fibrous-rooted Club Sphæria. Perf. n. 5. (*Clavaria radicata*; Bulliard t. 440. f. 2. C. *parafitica*; Willden. Berolin. 405. t. 7. f. 17. With. v. 4. 361.)—Stalk simple, yellowish, with a branched fibrous root. Head oval, turgid, black.—Native of sandy heaths, or fir woods, in autumn. Mr. Pitchford found it near Norwich, many years since, nor can there be any doubt respecting the above synonymy. His specimens, like those of Willdenow, grew parasitically, on the *Tuber cervinum*, one or two on each individual, to which they were attached by their long and much-branched fibrous roots. The *stalk*, about two inches high, is wavy or curved, roundish, of a dirty yellow, as well as the *root*. *Head* an inch long, when full grown, granulated, of a glaucous black, solid; pale yellow within.

S. Hypoxylon. Horned Black Sphæria. Perf. n. 7. Obf. Mycolog. fasc. 1. 20. t. 2. f. 1, a, f. Sowerb. Fung. t. 55. (*Clavaria Hypoxylon*; Linn. Sp. Pl. 1652. Hudf. 639. With. v. 4. 369. C. *cornuta*; Bulliard t. 180.)—Clustered, branched, compressed; black and hairy below; whitish and dilated at the summits.—Common on rotten stumps or posts, in woods and gardens, making a conspicuous appearance. Its usual height is three or four inches. The hairiness is most copious and coarse on young plants. In winter the summits of the branches are plentifully covered with white powder, but destitute of the spherical seed-vessels. The latter, according to Perfoon, are perfected in summer. His observations contradict the opinion reported by Withering after Dr. Waller, that the present species is the male of the following. Indeed that opinion is much invalidated by the assertion that *Clavaria ophioglossoides* of Linnæus, (see GEOGLOSSUM,) is only a variety of the *digitata*. Such a mistake is no otherwise accountable, than by supposing the person who made it took the species last described for the *Geoglossum*, and even then his accuracy of judgment could not rank high.

S. digitata. Finger-shaped Black Sphæria. Sowerb. Fung. t. 69. (*S. polymorpha*; Perf. n. 10. *Clavaria digitata*; Linn. Sp. Pl. 1652. Hudf. 639. With. v. 4. 368. Bulliard t. 220. Lichen-agaricus terrestris *digitatus niger*, &c.; Mich. Gen. 104. t. 54. ord. 2. f. 4.)—Clustered, club-shaped, obtuse, tumid, coal-black. Frequent on old rotten stumps in beech woods, as well as on old posts of different kinds, into which its long perennial roots deeply insinuate themselves, the fungus springing up every autumn, in the shape of numerous, simple or divided, hard, black, rough, finger-like bodies, whitish at the summit while young, and tapering below into very slender stalks. Perhaps *S. digitata*, Perf. n. 9, may be a variety only; but the Linnæan synonym belongs to what we have described.

SECT. 2. *Roundish or diffuse, without a stem*. Thirteen species.

S. concentrica. Concentric Black Sphæria. Perf. n. 11. Bolt. Fung. t. 180. (*S. fraxinea*; With. v. 4. 393. Sowerb. Fung. t. 160. *Lycoperdon fraxineum*; Hudf. 641; excluding the synonym of Micheli.)—Roundish, tumid, firm, smooth, with numerous concentric internal layers. Frequent on the decayed stumps of Ash, Willow,

and other trees. Usually coal-black, somewhat shining, in globular masses, the size of a chestnut, or larger, and of the substance and lightness of charcoal.

S. fragiformis. Orange Sphæria. Perf. n. 13. (*Lycoperdon variolofum*; Linn. Syst. Nat. ed. 12. v. 3. 234. Hudf. 645. Sowerb. Fung. t. 271.)—Clustered, somewhat confluent, of a rusty red; black and shining within. Seed-vessels minutely papillary, in the deciduous coat.—Frequent on rotten branches and stumps in damp woods. Each plant is the size of a pea, more or less, bright red when young. In an advanced state they become confluent, of a brick colour, and the coat, in which the minute seed-vessels are lodged, scales off, leaving a black central mass, mistaken by Mr. Sowerby for the seed.

SECT. 3. *Shape roundish, but various and indeterminate*. *Capsules scattered horizontally, with prominent orifices, often spinous*. Twenty-three species.

S. poronia. Dotted Cup Sphæria. Perf. n. 24. (*S. punctata*; Sowerb. Fung. t. 54. *Peziza punctata*; Linn. Sp. Pl. 1650. Bulliard t. 252.)—Stalked; cup-shaped, shallow, white in the disk, with black scattered sunk capsules.—Found in sandy countries, chiefly on horse-dung, rarely on that of cows. It looks like a stalked *Peziza*, scarcely half an inch broad, conspicuous for its white disk, dotted with the black seed-vessels. The substance is firm, or leathery.

S. deusta. Large Spreading Sphæria. Perf. n. 25. (*S. maxima*; Web. Goett. 286. Dickf. Crypt. fasc. 1. 23. *S. versipellis*; Tode Mecklenb. v. 2. 55. t. 17. f. 129. *Hypoxylon ustulatum*; Bulliard t. 487. f. 1. Lichen-agaricus crustaceus *crassius*, *bovinum renem veluti representans*, *niger et quasi deustus*; Mich. Gen. 104. t. 54. f. 1.)—Broad, indeterminate, thick, wavy and tumid; at first grey and powdery; finally black and rigid. Capsules sunk.—Not uncommon on old rotten stumps, over which it spreads, to the extent of two or three inches, in thick, diffuse, unequal masses, finally coal-black, and of the texture of *S. concentrica*, (see the preceding section,) with which Hudson and some other botanists have confounded it. The shape, however, is not globose, nor is the internal substance formed of concentric layers. The *capsules* moreover are larger, and very conspicuous in a vertical section of the plant, being closely ranged, in a simple series, under the external coat, through which their *seeds* are discharged by a slender tube belonging to each capsule.—Perfoon remarks, that this species sometimes acquires a kind of stalk, when growing on very rotten wood, or on the ground near an old stump.

S. ceratosperma. Horn-seeded Sphæria. Perf. n. 38. (*S. Ceratospermum*; Tode Mecklenb. v. 2. 53. t. 17. f. 131. *Ceratospermum nigrum minimum discoides, e diversarum arborum ramorum emortuarum corticibus, et præcipuè corylo erumpens*; Mich. Gen. 125. t. 56. f. 1.)—Roundish, convex, scattered, black. Capsules with long prominent beaks.—Found by Micheli in woods near Florence, chiefly on dead branches of hazel, in the winter. Tode observed it in July, on the dead bark of *Rosa canina*. Each plant is less than a split pea, seated on the dead wood or bark, under the cuticle, and soon becomes distinguished by the protrusion of numerous little black horn-like excrescences, which appear to be the prominent beaks of the sunk *capsules*. Tode's figures, however, do not precisely accord with those of Micheli. We once examined the original specimens of the latter writer, but the horn-like processes had disappeared; nor have we met with any thing in England answerable to this species, though many which belong to Perfoon's eighth, or last, section are sufficiently similar

similar in their mode of growth to explain the nature of that before us.

SECT. 4. *Shape indeterminate. Capsules horizontal; at first marginal, and separate; afterwards confluent.* Twenty-four species.

Perfoon himself doubts the certainty of this section, some of the species seeming rather to belong to that immediately preceding, others perhaps to the eighth.

S. graminis. Grass Sphæria. Perf. n. 50. Obf. Mycol. fasc. 1. 18. t. 1. f. 1 and 2.—Linear-oblong, forming shining black spots upon leaves. Capsules globose, without prominent beaks.—Observed by Perfoon on the leaves of *Elymus europæus* and *Lolium perenne*, in the shape of oblong, black, slightly prominent spots, various in length, which, when cut vertically, display a series of sunk globular capsules, not projecting above the surface.

The rest of this section are similarly parasitical on the leaves or stalks of various plants.

SECT. 5. *Capsules crowded into an elevated tuft, on a common crustaceous receptacle; their beaks converging.* Fifteen species.

S. ferruginea. Rusty-crust Sphæria. Perf. n. 62. Obf. Mycol. fasc. 1. 66. t. 5. f. 1, 2.—Capsules black, with taper straight beaks; their bases surrounded with rusty powder.—Gathered by Perfoon, on dry branches of hazel. It bursts from under the cuticle in little oblong transverse prominent masses, of which nothing appears but the taper spine-like beaks of the little black capsules. When laid bare, a powdery rusty mass, like a crust, is found to accompany the capsules, but Perfoon suspects this may possibly originate from the wood. His figure is admirable, as usual with all that he has published.

SECT. 6. *Capsules ranged circularly, mostly decumbent, without a crust, lodged under the cuticle of plants, their orifices generally crowded together.* Fourteen species, which might perhaps have been comprehended in the last section.

S. convergens. Converging Sphæria. Perf. n. 86. Tode Mecklenb. v. 2. 39. t. 14. f. 111.—Aggregate, slightly prominent. Capsules black, ovate, with straight beaks, all meeting in a point.—On the branches of trees, especially between the bark and cuticle of beech when dry. It consists of little black tubercular spots, each formed of a few minute capsules, ranged circularly, whose beaks, about their own length, meet in a conical point. There are no traces of any crust, or common basis.

S. salicina. Aggregate Willow Sphæria. Perf. n. 88. Obf. Mycol. fasc. 1. 64. (*S. cancellata*; Tode Mecklenb. v. 2. 34. t. 13. f. 107.)—Aggregate, circular. Mouth of the capsules conerected into a rugged perforated disk.—Not rare on dead dry branches of Willows, according to Tode and Perfoon, giving them the roughness of a file when handled. The minute black capsules are so combined at their orifices, eight or ten in each circular assemblage, as to form one body, united by a rugged or reticulated, woody or fungous, substance, of a grey or dirty white.

SECT. 7. *Capsules distinct, forming a roundish tuft, on a common receptacle, and bursting through the cuticle of plants.* Eleven species.

S. coccinea. Scarlet Sphæria. Perf. n. 92. (*S. decidua*; Tode Mecklenb. v. 2. 31. t. 13. f. 104.)—Tufted, pale red. Capsules ovate, smooth.—Said to be not unfrequent on dead branches of beech; consisting of scattered oval tufts, half the size of a pea, bordered by the reflexed torn cuticle of the branch. The capsules are minute, half sunk in the tumid receptacle, each with a short beak. There is a larger and brighter-coloured variety, found by Dr. Roth on the elder.

S. populina. Poplar Sphæria. Perf. n. 94. Obf. Mycol. fasc. 2. 67. t. 5. f. 10, 11.—Tufted, black. Capsules numerous, ovate, smooth, somewhat spreading, seated on a dense receptacle.—On the branches of poplars, but not common. It forms little black scattered tufts, each composed of 25 or 30 ovate, pointed, sessile capsules, divaricated at the points, and, though crowded, quite unconnected at the base.

S. aueuparia. Mountain-ash Sphæria. Perf. n. 96. (*S. cæspitosa*; Tode Mecklenb. v. 2. 41. t. 14. f. 113.)—Tufted, black, powdered with white. Receptacles aggregate, palmate, each bearing several cylindrical capsules.—On dead branches of the mountain-ash in May. This bursts in round, black, hard masses, from under the cuticle of the tree, each the size of a vetch-seed. When magnified, each tuft appears to consist of many hand-shaped erect portions, whose finger-like points are supposed to be the capsules; but the whole seems a very obscure production, nor has it ever fallen under our observation.

SECT. 8. *Capsules solitary, distinct, destitute of a receptacle.* Eighty-three species, subdivided according to the shape or proportion of the mouths, or beaks, of the capsules.

S. pileata. Cap Sphæria. Perf. n. 102. (*S. macrostoma*, var. ϵ , *pileata*; Tode Mecklenb. v. 2. 13. t. 9. f. 78.)—Simple, globose; its mouth inversely conical, flat at the top, with a linear orifice.—Found sunk in the bark of dead branches of trees, in the early spring. Tode. The size of poppy-seed, black and smooth, crowned with a discoid dilatation, in which the mouth is seated.

S. debilens. Wide-mouthed Sphæria. Perf. n. 106. (*S. macrostoma*, var. α , β , γ ; Tode Mecklenb. v. 2. 12. t. 9. f. 76.)—Simple, globose, immersed; its mouth compressed, with tumid lips.—Found sunk in the wood itself of rotten branches of trees, in the month of April. Very near the last, from which Tode considered it as not specifically distinct. The only difference consists in the lips prominent, and not conical, form of the lips of the capsule.

S. rostrata. Needle-beaked Sphæria. Perf. n. 112. Tode Mecklenb. v. 2. 14. t. 9. f. 79.—Simple, naked, globose, granulated, with a very long taper-pointed beak.—Found more or less immersed in rotten beech wood. Each plant consists of a globular, rugged, black, thickly coated capsule, the size of coarse sand, with a curved, sharp, slender beak, four or five times its own length.

S. acuta. Sharp-mouthed Sphæria. Perf. n. 122. Obf. Mycol. fasc. 2. 70. Sowerb. Fung. t. 119.—Scattered, naked, black, shining, depressed, with a cylindrical sharp beak.—Found on the dead stalks of nettles more especially, in the spring. First observed in England by the Rev. Mr. Relhan. It grows in a rather scattered manner; each plant like a minute bottle, vertically flattened.

S. Peziza. Scarlet-cup Sphæria. Perf. n. 129. Tode Mecklenb. v. 2. 46. t. 15. f. 122. (*S. miniata*; Hoffm. Germ. v. 2. t. 12. f. 1. *Peziza hydrophora*; Bulliard t. 410. f. 2. *Lycoperdon hydrophorum*; Sowerb. Fung. t. 23.)—Crowded, dull red, globose, somewhat hairy; at length depressed and concave.—Frequent in the hollows of rotten trees in autumn, composing broad patches, of a dull fearful hue. Each plant is smaller than a mustard-seed, externally roughish or hairy. If Mr. Sowerby be right, the seeds appear to form a white ball, which is protruded out of the capsule, after which the latter becomes depressed and hollow, as all authors describe it when advanced. See somewhat similar in the character of *SPHÆROBOLUS* in its proper place.

S. hispida. Brittly Sphæria. Perf. n. 144. Tode Mecklenb. v. 2. 17. t. 10. f. 84.—Simple, scattered, pear-

shaped, black, clothed with scattered spreading bristles.—Found by Tode on oak branches, stripped of their bark, in September. Each individual is about half a line long, erect, ovate, tapering into a short thick mouth; the outside beset with spreading bristles, which well mark the species.

S. herbarum. Flat Common Sphæria. Perf. n. 153. (*S. complanata*; Tode Mecklenb. v. 2. 21. t. 11. f. 88.)—Simple, scattered, orbicular, more or less depressed, smooth, brown, with a nipple-shaped mouth.—Copious on the dried stalks of various herbaceous plants. Each specimen is about the size of the smallest pin's head. See *S. Saturnus*, Sowerb. Fung. t. 218.

S. moriformis. Mulberry-shaped Sphæria. Perf. n. 168. Tode Mecklenb. v. 2. 22. t. 11. f. 90, 91.—Simple, feathered, elliptical or roundish, closed, tuberculated, black.—Said to be not unfrequent on dead branches, especially of firs. This, like all the following, belongs to a tribe of species destitute of a beak, or any perceptible orifice. Its size is about equal to mustard-feed. The whole surface is tuberculated. The shape elliptical, or globular. Perhaps this may be *S. claviformis*, Sowerb. Fung. t. 337.

S. comata. Tufted Sphæria. Perf. n. 170. Tode Mecklenb. v. 2. 15. t. 10. f. 81.—Simple, crowded, globose, crowned with a converging tuft of capillary fibres, twice its own length.—Observed by Tode on the dead stems and stalks of plants after rain. This is a very remarkable species, on account of the dense tuft of fibres, invariably found to crown the summit of each specimen, and which, therefore, has no appearance of being of an extraneous or parasitical nature. Indeed there are instances of bristles or hairs, either generally or partially clothing some other species. The general colour is black, but a brown variety has been noticed, though rarely, on rotten wood of willows.

S. cylindrica. Cylindrical Ball-bearing Sphæria. Perf. n. 180. Tode Mecklenb. v. 2. 42. t. 15. f. 114.—Simple, scattered, cylindrical, black, bearing a globe of white feeds.—Found by Tode on rotten willows, protruding from the wood in the form of minute, scattered, black points, hardly visible to a casual observer, each crowned by a little white ball of feeds, which betrays some analogy to that of *S. Peziza*; inasmuch that one might almost think such a character, if well ascertained in some other species, might form a generic distinction. We know, however, too little of the different changes, which the fructification of many of the rest undergo, to draw a line between them, and these powdery balls, being doubtless liquid in an early state, come under the essential definition of *Sphæria*. The character of *Nemaspora* of authors, consisting in the permanently gelatinous nature of what its capsules discharge, seems to keep that genus sufficiently distinct from the present.

SPHÆRISTERIUM, σφαιριστήριον, in *Antiquity*, the seventh part of the ancient gymnasium; being that in which the youth practised tennis-playing.

The sphæristerium, or tennis-court, was between the place named *palaestra*, and that where they ran races, which was between the porticoes and the outer wall, though Vitruvius does not make mention of it in the description he gives of the ancient gymnasium.

The exercise here performed was called σφαιριστική, *sphæristica*, and σφαιρομαχία, *sphæromachia*, which some will have to have differed from the modern tennis; but it is not known in what the difference consisted.

The Milesians were particularly averse from this exercise; and the Athenians were as remarkably fond of it. These latter frequently gave the freedom of their city to the sphæristæ, or masters in this art, by way of compliment.

SPHÆROBOLUS, in *Botany*, so named by Tode,

from σφαῖρα, a globe, and βολος, a cast, or throw; because the feeds are forcibly ejected, in the form of a little round ball.—Tode Mecklenb. v. 1. 43. Perf. Syn. 115. (Carpobolus; Mich. Gen. 221. t. 101. Willd. Berol. 414.)—Class and order, *Cryptogamia Fungi*. Nat. Ord. *Fungi, angiocarpi*.

Ess. Ch. Receptacle nearly globose, at length splitting into rays, and discharging elastically the globose seed-vessel.

1. *S. bellatus*. Starry Projectile Puff-ball. Perf. n. 1. (Lycoperdon Carpopolus; Linn. Sp. Pl. 1654. Hudf. 644. Sowerb. Fung. t. 22.)—Found in various parts of Europe, in autumn, upon rotten wood or branches of trees, heaps of saw-dust, or in the tan-pits of hot-houses. In an early state each plant consists of a pale yellow globe, larger than a mustard-feed. Several such grow crowded together in patches, bound down, as it were, with a fine cottony web. After a while, each plant bursts into several starry rays, and, by a momentary explosion, projects, to the distance of six or eight inches, a whitish globular mass of powdery feeds from its internal cavity. Sometimes this ball of feeds remains sticking to the points of the rays. When fallen to a distance, the skin of the ball is found empty, the feeds having flown out in its passage through a hole at the base, which is usually bordered by an inner layer of the outer starry case, or *wolva*, torn away by the ball.

We do not perceive the necessity of changing the original generic name, given by Micheli, whose figures and description of this curious little fungus long excited the curiosity of botanists, before the plant was known to be so frequent as it is. Mr. Sowerby gives the best representation of it. Tode describes a second species, which can scarcely belong to the same genus, and which is figured under the name of *Peziza marginata*, in Sowerby's *Fungi*, t. 16, and under that of *Patellaria excavata*, in Hoffmann's *Plantæ Lichenosæ*, t. 23. t. 3. Albertini and Schweiniz mention this production with doubt, in their learned work on the Niskian Fungi, p. 346. n. 1034; but it seems not as yet well understood.

SPHÆROCARPUS, so named by Micheli, from σφαῖρα, a globe, and καρπος, fruit, in allusion to its spherical seed-vessel.—Mich. Gen. 4. Sm. Engl. Bot. v. 5. 299. Relh. 441. Mart. Mill. Dict. v. 4.—Class and order, *Cryptogamia Algæ?* or perhaps *Hepaticæ?* Nat. Ord. *Hepaticæ?*

Ess. Ch. Calyx inferior, of one leaf, inflated, entire. Seeds very numerous, collected into a globe, at the bottom of the calyx.

1. *S. terrestris*. Reticulated Sphærocarpus. Engl. Bot. t. 299. (*S. terrestris, minima*; Mich. Gen. 4. t. 3. Dill. Mulc. 536. t. 78. f. 17. Targionia Sphærocarpus; Dickf. Crypt. fasc. 1. 8. With. v. 3. 814.)—Micheli first observed this singular little plant in gardens about Florence, in the winter and spring, growing in patches on the ground. The Rev. H. Bryant, Mr. Crowe, and Mr. Woodward, found it, since the publication of Hudson's 2d edition, chiefly in the clover and turnip fields of Norfolk, especially on strong land, covering the earth copiously in the winter months, in patches of a pale glaucous green. The whole habit is delicate and membranous. Fronds simple, roundish or ovate, crowded, wavy, each attached by a fibrous, probably annual, root. The disk of each frond is nearly covered by an assemblage of pear-shaped, reticulated, pellucid, bottle-like calyces, each a line long, contracted at the mouth, and lodging a little ball of green feeds at the bottom of its cavity, clothed with a fine skin. This plant seems to us essentially distinct in genus from TARGIONIA, (see that article,) and more allied to *Blasia* and *Jungermannia*.

SPHÆROCARPUS is also applied by some authors to designate a genus of *Fungi*, the *TRICHIA* of others. See that article.

SPHÆROCARPUS of Gmelin, in his faulty edition of Linn. Syst. Nat., is a scitamineous genus, the *Hura* of Koenig, now considered as a *Globba*.

SPHÆROLOBIUM, was so named by the writer of this article, from σφαῖρα, a globe, and λοβιον, the diminutive of λοβος, a pod, to express the roundish form of its very small legume.—Sm. in Sims and König's Ann. of Bot. v. 1. 509. Brown in Ait. Hort. Kew. v. 3. 13.—Class and order, *Decandria Monogynia*. Nat. Ord. *Papilionaceæ*, Linn. *Leguminosæ*, Jull.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, permanent, bell-shaped, two-lipped; tube angular; upper lip in two abrupt oblique segments, united about half way up; lower in three deep, lanceolate, equal ones; without any lateral appendages. *Cor.* Papilionaceous, of five petals, with claws which are shorter than the calyx; standard kidney-shaped, emarginate, ascending; wings two, half obovate, rather shorter than the standard, converging at the upper margin; keel equal to the wings, of two oblong cohering petals. *Stam.* Filaments ten, linear-awl-shaped, separate, declining, shorter than the keel, the two uppermost with a space between them; anthers roundish, two-lobed. *Pist.* Germen stalked, roundish; style linear, keeled, rigid, obliquely rolled inward, about equal to the keel; stigma smooth, with a membranous dilatation at each side. *Peric.* on a stalk half its own length, obliquely orbicular, turgid, pointed, of one cell and two coriaceous valves. *Seeds* one or two, kidney-shaped.

Ess. Ch. Calyx five-cleft, two-lipped. Corolla papilionaceous. Stigma keeled, with a membranous border. Legume stalked, spherical, turgid, oblique. Two upper flaments distant.

1. *S. vimineum*. Yellow-flowered Sphærolobium. Sm. Tr. of Linn. Soc. v. 9. 261. Sims in Curt. Mag. t. 969. Ait. n. 1.—“Tube of the calyx rather shorter than the lips. Style curved from the very base, included in the keel.” *Brown*.—Native of New Holland and Van Diemen's island. Our specimens were originally sent, in 1793, from Port Jackson by Dr. White. Sir Joseph Banks is said to have introduced the plant at Kew in 1802. It flowers during summer, requiring the shelter of a greenhouse in winter. The stem is erect, shrubby, branched, round, smooth, mostly naked, the youngest branches only bearing a few scattered, small, lanceolate leaves. Flowers numerous, in long straight clusters, rather small. Calyx smooth, a little glaucous. Corolla yellow, the disk of the standard marked with a transverse row of red dots. Legume the size of a vetch-seed.

2. *S. medium*. Small Red-flowered Sphærolobium. Ait. n. 2.—“Tube of the calyx half the length of the lips. Corolla red.” *Brown*.—Observed by Mr. Brown, on the south-west coast of New Holland, from whence it was sent to Kew, by Mr. Peter Good, in 1803. We know nothing of this plant, except the above particulars, borrowed from the *Hortus Kewensis*. The name seems to imply the existence of a third species, of which we have no account.

SPHÆROMACHIA, σφαιρομαχία, in *Antiquity*, a particular kind of boxing, in which the combatants had balls of stone or lead in their hands, which were called σφαίραι.

SPHÆROPHORON, in *Botany*, from σφαῖρα, a globe, and φέρω, to bear, because of the globular fructification.—Ach. Meth. 134. Lichenogr. 116. t. 12. f. 5, 6. Syn. 286. (Sphærophorus; Perl. in Uit. Annal. fasc. 7. 23.)

—Class and order, *Cryptogamia Algæ*. Nat. Ord. *Algæ*, *Lichenes*.

Ess. Ch. *Receptacle* nearly globular, without a border, cartilaginous, with a torn orifice. *Seeds* composing a black powdery ball.

This most elegant genus of the natural family of Lichens, is at once known by its branched, bushy, smooth habit, like that of a coral or coralline. Three species are known.

1. *S. coralloides*. Coral-branched Globe-Lichen. Ach. Syn. n. 1. (Lichen globiferus; Linn. Mant. 133. Engl. Bot. t. 115. L. fruticosus coralloides, non tubulosus, cinereus ramosissimus, receptaculis florum sphæricis concoloribus; Mich. Gen. 103. t. 39. f. 6. Coralloides cupressiforme, capitulis globosis; Dill. Musc. 117. t. 17. f. 35. C. globiferum; Hoffm. Pl. Lich. v. 2. 25. t. 31. f. 2.)—Stem pale brown, cylindrical; its lateral branches elongated, divaricated, forked, with slender white tips. Receptacles globose, smooth.—Native of mountainous rocky heaths, and fir woods, in the cooler parts of Europe. Abundant in Scotland, Wales, Derbyshire, &c. The smooth polished brownish stems compose lax tufts, an inch or two high, soft and pliant when wet, very brittle when dry, resembling little groves of coral. The flowering stems are stouter, more simple, and rather taller than the rest, their strongest branches each terminating in a smooth ball of their own substance and colour, smaller than a pea, opening by a torn mouth at the summit, and containing a dense ball of very black powdery seeds.

2. *S. fragile*. Brittle Globe-Lichen. Ach. Syn. n. 2. Meth. 135. t. 3. f. 5. Engl. Bot. t. 2474. (Lichen fragilis; Linn. Pl. Suec. ed. 2. 425. Fl. Lap. ed. 2. 351. t. 11. f. 4. Ehrh. Crypt. 128. Coralloides fragile; Hoffm. Pl. Lich. v. 2. 34. t. 33. f. 3.)—Stem greyish; its branches crowded, forked, round. Receptacles obovate, rugose. Native of mossy rocks and mountains in the north of Europe. We have found it on the Pentland hills, near Edinburgh, but without fructification. In this state it forms broad patches of dense, pale grey, branching stems, whose branches are round, somewhat annular, obtuse, level-topped. In some German and Swedish specimens, larger and stouter branches bear obovate or pear-shaped receptacles, or seed-vessels, of a dark brown, whose surface is cracked or corrugated, their size about equal to the preceding.

3. *S. compressum*. Compressed Globe-Lichen. Ach. n. 3. (Lichen fragilis; Linn. Sp. Pl. 1621. Jacq. Misc. v. 2. 92. t. 9. f. 6, c. Engl. Bot. t. 114. L. melanocarpus; Swartz Prodr. 147. Coralloides alpinum, corallinæ minoris facie; Dill. Musc. 116. t. 17. f. 34.)—Stem white; its branches compressed. Receptacles somewhat lateral, depressed, smooth.—Found in moist places, under the shade of rocks, on the mountains of Germany, Switzerland, and England, as well as in the West Indies, and at the Cape of Good Hope. This beautiful species, in the polished white of its surface, and its flat palmate ramifications, exceeds the elegance of the foregoing, and still more resembles a coralline. The height of the branching fan-like stem is two or three inches, and the fructification, when present, is copious, usually turned to one side, flattened, often bordered with granulations or shoots; the powder intensely black, mixed with fibres of the same colour.—In the account given in English Botany, the idea of the last species, in a barren state, was comprehended under this.

SPHAGNITES, a name given by some authors to the jugular veins.

SPHAGNUM, in *Botany*, a name used by Pliny for some sort of moss that grows upon trees, adopted by Dil-

lenius and Linnæus, for the genus now called Bog-mofs.—Dill. Musc. 240. Linn. Gen. 562. Schreb. 758. Mart. Mill. Dict. v. 4. Hedw. Fund. v. 2. 85. Theor. t. 12. Sp. Musc. 27. Sm. Fl. Brit. 1145. Juss. 12. Lamarck Illustr. t. 872.—Class and order, *Cryptogamia Musci*. Nat. Ord. *Musci*.

Eff. Ch. Capsule sessile, without a fringe. Veil cut round, its base remaining on the base of the capsule. Anthers each surrounded with a ring.

Obf. Weber and Mohr have justly remarked, that this is the only known genus of mosses in which the germs and capsule are truly sessile, not at any stage of growth elevated on a *pedicellus*, or partial stalk, above the base of the flower. The whole flower indeed, and consequently the ripe capsule, is stalked, which being rarely the case with other mosses, whose *pedicelli* are very long, the two different kinds of stalk have been confounded together.

1. *S. latifolium*. Broad-leaved Bog-mofs. Hedw. Sp. Musc. 27. Fl. Brit. n. 1. Engl. Bot. t. 1405. Turn. Musc. Hib. 5. (*S. palustre* α ; Linn. Sp. Pl. 1569. Fl. Dan. t. 474. *S. palustre molle deflexum*, squamis cymbiformibus; Dill. Musc. 240. t. 32. f. 1.)—Branches tumid, deflexed. Leaves ovate, obtuse, concave. This moss occupies the surface of watery turfy bogs throughout Europe, bearing capsules in summer. Its pale whitish-green hue, often tinged with red, makes the plant conspicuous. The large masses it composes are mostly filled with water, like a sponge, and are not firm enough to be walked upon. *Drosera*, *Erica tetralix*, and the Cranberry, are the chief plants that grow amongst it, often without being rooted in the ground. The stems are various in height, soft and flexible, beset with numerous, short, tumid, tapering branches, slightly bent downward; the uppermost crowded. Leaves imbricated, pellucid, broad, obtuse, entire, incurved, reticulated, without rib or veins. Capsules about the tops of the stems, erect, brown, smooth, on flower-stalks not an inch long. Lid almost flat. Veil thin, more or less of its circular base remaining round the capsule. The softness and elasticity of this moss render it very fit for packing.

2. *S. squarrosolum*. Prominent-leaved Bog-mofs. Mohr Ind. 2. Sm. Compend. ed. 2. 159. Engl. Bot. t. 1498.—Branches deflexed, tapering. Leaves ovate, acute, with recurved, prominent, keeled points.—Native of Germany, Sweden, and England. Mr. Turner gathered this species, which the late Mr. Mohr only had previously mentioned, not described, on bogs at Belton, near Yarmouth, bearing fruit in June and July. It differs from the foregoing in the more taper terminations of the branches, and especially in the spreading recurved points of its leaves, which have a central fold like a keel, and give the squarrose character of the plant. The capsules have a prominent beaked lid.

3. *S. capillifolium*. Slender Bog-mofs. Hedw. Sp. Musc. 28. Fl. Brit. n. 2. Engl. Bot. t. 1406. Turn. Musc. Hib. 6. (*S. palustre* β ; Linn. Sp. Pl. 1569. *S. palustre molle deflexum*, squamis capillaceis; Dill. Musc. 243. t. 32. f. 2, A.)—Branches slender, deflexed. Leaves ovato-lanceolate, pointed, flattish, close-pressed, with straight points.—Abundant on bogs, especially in rather mountainous situations, bearing capsules in summer, and often tinged with red. Its much smaller size, and narrower flatter leaves, distinguish this from both the preceding. The reticulations of the foliage are observed by Mr. I. D. Sowerby to be peculiar, the little transverse veins running in pairs. Sometimes a fold, or keel, resembling a mid-rib, is discernible.

4. *S. cuspidatum*. Long-leaved Floating Bog-mofs. Hoffm. Germ. v. 2. 22. Fl. Brit. n. 3. Engl. Bot. t. 2092. Ehrh. Crypt. 251. Turn. Musc. Hib. 6. (*S. palustris mollis deflexi*, squamis capillaceis, varietas fluitans; Dill. Musc. 244. t. 32. f. 2, B.)—Branches spreading, rather downwards. Leaves lanceolate, long-pointed, wavy, lax.—Most frequent, in pools or rivulets, among bogs in mountainous countries, but Mr. Turner found it near Yarmouth, bearing fruit in summer. This resembles the common *latifolium* in colour, but the more elongated floating stems, distinguish the species before us. The branches are loosely directed downward, pointed, often very slender. The reticulations of the leaves most accord with those of our last species; but their points are more elongated, and edges wavy. Capsule short, and rather bell-shaped when fully ripe.

We have thus brought together four species of the present genus. Hedwig has but two, besides the *S. alpinum* of Linnæus, figured in Dillenius, t. 32. f. 3, which is founded in an error of the last-mentioned author. What he described and delineated, prove to be nothing more than luxuriant bog specimens of *Dicranum flexuosum* of Hedwig and Fl. Brit., Engl. Bot. t. 1491, among which some extraneous bodies had fallen, and these were mistaken for capsules.

SPHENE, in *Mineralogy*, a mineral composed of nearly equal parts of oxyd of titanium, silica, and lime. Its colours are generally a dark brown, inclining to red or yellow. It occurs crystallized in various forms, and also sometimes in masses. The crystals are more frequently four-sided prisms, either oblique or rectangular, or six-sided prisms, with two opposite sides broader than the rest, or elongated octohedrons. The edges of the crystals are frequently bevelled, and the apices of the octohedrons are sometimes flattened as to present a lenticular form.

The fracture of sphene is imperfectly conchoidal; it scratches glass, and is brittle. The internal lustre is shining, inclining to resinous. The specific gravity is from 3.480 to 3.510. It is fusible by the blowpipe into a blackish-brown enamel. This mineral is found imbedded in sienite and granite in various parts of Scotland, and also in Sweden, Norway, France, Switzerland, and in North America. The name sphene was given to this mineral by Häüy, from the wedge-like shape of some of the crystals.

Foliated sphene differs from the above in colour, which is various shades of yellow, inclining to a straw or cream colour, and in the structure, which is foliated, with a double cleavage parallel to the side of an oblique four-sided prism. The cross fracture is foliated. Both these varieties of sphene pass from different degrees of translucency to opacity.

SPHENOCLEA, in *Botany*, so denominated by Gærtner, from $\sigma\phi\eta\nu$, a wedge, and $\kappa\lambda\iota\nu$, to shut up, because of the wedge-shaped seed-vessel.—Gærtner, v. 1. 113. t. 24. f. 5. Willd. Sp. Pl. v. 1. 927. (Gærtnera; Retz. Obs. fasc. 6. 24. Rapinia; Loureir. Cochinch. 127. Pongatium; Juss. 423.)—Class and order, *Pentandria Monogynia*. Nat. Ord. *Lysimachiaz*, Juss. ?

Gen. Ch. Cal. Perianth superior, of five roundish, permanent leaves, broad at the base. Cor. of one petal, shorter than the calyx; tube very short; limb in five lanceolate, equal, erect segments. Stam. Filaments five, capillary, very short, inserted into the tube of the corolla; anthers roundish, two-lobed. Pist. Germen inferior, compressed at the base; style very short; stigma capitate, permanent.

manent. *Peric.* Capsule compressed, wedge-shaped, quadrangular, obtuse, of two cells, bursting all round near the top. *Seeds* very numerous, minute, oblong, affixed to a pendulous receptacle in each cell.

Ess. Ch. Corolla five-cleft, smaller than the calyx. Capsule compressed, of two cells, bursting all round. Seeds numerous. Receptacles curved downwards. Stigma capitate, permanent.

1. *S. zeylanica*. Willd. n. 1. (Pongati; Rheede Hort. Malab. v. 11. 47. t. 24.)—Native of moist situations in the East Indies, Cochinchina, Ceylon and Guinea. The root is fibrous and annual. *Stem* erect, one or two feet high, simple or branched, leafy. *Leaves* scattered, stalked, lanceolate, entire, smooth, somewhat fleshy, about two inches long, of a pale rather glaucous green. *Flowers* greenish-white, in dense, terminal, erect, cylindrical spikes, of no beauty, nor do we know that the plant has any valuable properties. Its general aspect is that of some kind of *Reseda*, particularly the *R. Luteola*. It was originally chosen by sir Joseph Banks to commemorate the eminent botanical merits of Gærtner, for which the striking peculiarities of its seed-vessel made it very eligible; but there is now another GÆRTNERA, of equal singularity and more beauty. See that article.

SPHENOGYNE, apparently from σφην, a wedge, and γυν, a female, in allusion to the wedge-shaped stigmas.—Brown in Ait. Hort. Kew. v. 5. 142.—Class and order, *Syngenesia Polygamia-frustranca*. Nat. Ord. *Compositæ discoideæ*, Linn. *Corymbifera*, Juss.

Gen. Ch. Common Calyx roundish, imbricated; its scales rounded or awl-shaped, concave, with a membranous dilated border, most conspicuous on the inner ones. *Cor.* compound, radiated; florets of the disk numerous, funnel-shaped, five-cleft, equal, all perfect; those of the radius about twenty, ligulate, longer than the diameter of the disk, toothed at the end imperfectly, female. *Stam.* in the florets of the disk, filaments five, capillary, short; anthers united into a tube, nearly as long as the corolla. *Pist.* Germen scarcely discernible in the florets of the radius; in those of the disk oblong, quadrangular; style thread-shaped in both; stigmas in the florets of the radius obsolete; in those of the disk dilated upwards, rather abrupt at the summit. *Peric.* none, except the permanent dry calyx. *Seeds* in the disk only, angular. Down of five rounded, membranous, horizontal scales. *Recept.* chaffy, flattish.

Ess. Ch. Scales of the receptacle distinct. Seed-down of five simple membranous leaves. Stigma dilated upwards, abrupt. Calyx imbricated; its inner scales with a membranous border.

1. *S. anthemoides*. White-crowned Sphenogyne. Ait. n. 1. (Arctotis anthemoides; Linn. Sp. Pl. 1307. Willd. Sp. Pl. v. 3. 2361. Curt. Mag. t. 544. Chamæmelum pumilum, foliis angustis pinnatis; Burm. Afr. 174. t. 63. f. 2.)—Herbaceous, smooth. Leaves simply or doubly pinnatifid, linear-thread-shaped. Seed-down white, with brown awl-shaped ribs.—A native of the Cape of Good Hope, which proves a hardy annual in our gardens, flowering from July to September. Mr. Masson introduced it in 1774. The root is fibrous. *Stem* branched. *Leaves* somewhat like chamomile. *Flowers* terminal, solitary, stalked, an inch and half or more in diameter; yellow above; their rays purple underneath. The pure white chaffy seed-crown, radiated with brown, forms the most striking part of the plant, and may be preserved with everlasting flowers through winter.

2. *S. crithmifolia*. Samphire-leaved Sphenogyne. Ait. n. 2. (Arctotis paleacea; Linn. Sp. Pl. 1307. Willd.

Sp. Pl. v. 3. 2359. After foliis integris angustis, flore magno luteo; Burm. Afr. 176. t. 65. f. 1.)—Shrubby, smooth. Leaves pinnatifid, linear-thread-shaped. Outer scales of the calyx awl-shaped.—Native of the Cape of Good Hope. A greenhouse shrub, cultivated by Miller, flowering throughout the summer. The stem is bushy. *Flowers* large, yellow. Inner scales of the calyx very broad and rounded, while the outer are awl-shaped, and scarcely membranous.

3. *S. scariofa*. Scaly-cupped Sphenogyne. Ait. n. 3. (Arctotis scariofa; Ait. ed. 1. v. 3. 274. Willd. Sp. Pl. v. 3. 2360.)—"Leaves simply or doubly pinnatifid, linear-thread-shaped, smooth. All the scales of the calyx membranous, obtuse, shining; the outermost sessile."—Sent by Mr. Masson from the Cape in 1774. A greenhouse shrub, flowering from April to August. Differs from the last in having all its calyx-scales dilated and membranous.

4. *S. abrotanifolia*. Southernwood-leaved Sphenogyne. Brown MSS. Ait. n. 4.—"Shrubby. Leaves twice or thrice pinnatifid, downy as well as the calyx."—A greenhouse shrub, sent by Mr. Masson from the Cape in 1789, and flowering all summer long.

5. *S. dentata*. Small-leaved Sphenogyne. Ait. n. 5. (Arctotis dentata; Linn. Sp. Pl. 1307. Willd. Sp. Pl. v. 5. 2359. Chrysanthemum foliorum pinnis brevissimis, dentatis; Burm. Afr. 175. t. 64.)—Shrubby. Leaves pinnatifid, nearly smooth; each segment with two or three divaricated hair-pointed teeth. Outer scales of the calyx ovato-lanceolate.—From the same country. A greenhouse shrub, flowering in June and July, introduced in 1787, by Mr. John Hunnemann. The leaves are copious, short, and crisp. *Flowers* hardly an inch broad, yellow. Points of the calyx-scales downy; the inner ones bearing a very thin, pellucid, orbicular appendage.

6. *S. odorata*. Smooth-leaved Sphenogyne. Ait. n. 6. (Anthemis odorata; Ait. ed. 1. v. 3. 238. Willd. Sp. Pl. v. 3. 2186.)—"Shrubby. Leaves flat, smooth; cut or pinnatifid at the extremity. Outer calyx-scales membranous at the point. Seeds smooth, with a slight crown."—Sent by Mr. Masson from the Cape in 1774. A greenhouse shrub, flowering from April to June. The branches are downy. *Leaves* small, half an inch long. *Flowers* on very long, almost naked, stalks.

SPHENOID, in *Anatomy*, one of the bones of the head. See CRANIUM.

SPHENO-MAXILLARY FISSURE, a large interval, in the lower and outer part of the orbit, between the sphenoid and upper jaw-bones. See CRANIUM.

SPHENO-PALATINE FORAMEN, an opening between the sphenoid and palate bones, leading into the nose. The same epithet is also given to certain nerves which go through that opening, and to the levator palati muscle.

SPHENO-PHARYNGEUS, a name applied to a part of the constrictor pharyngis superior muscle. See DEGLUTITION.

SPHENO-PTERYGO-PALATINUS, a name given by Cowper to the circumflexus palati muscle. See DEGLUTITION.

SPHENO-SALPINGO-PHARYNGEUS, a small portion of the superior constrictor of the pharynx, described under this name by Winslow.

SPHENO-SALPINGO-STAPHYLINUS, a name given by Winslow to a portion of the circumflexus palati.

SPHENO-STAPHYLINUS, the levator palati mollis, according to Drake and Cowper.

SPHERE, SPHÆRA, σφαῖρα, in *Geometry*, a solid body contained under one single surface, and having a point in the

SPHERE.

the middle, called the *centre*, whence all lines, drawn to the surface, are equal.

The sphere is supposed to be generated by the revolution of a semicircle ABC (*Plate XIV. Geometry, fig. 2.*) about its diameter AC, which is also called the *axis of the sphere*; and the extreme points of the axis, A and C, are called the *poles of the sphere*.

SPHERE, Properties of the. 1. A sphere is equal to a pyramid, whose base is equal to the surface, and its height to the radius of the sphere.

Hence, a sphere being esteemed such a pyramid, its cube, or solid content, is found like that of a pyramid.

2. A sphere is to a cylinder, standing on an equal basis, and of the same height, as 2 to 3. Hence, also, may the cube, or content of the sphere, be found.

3. A sphere is equal to four times the cone, the base of which is equal to the generating circle, and the height of which is equal to the radius. Or, a hemisphere is equal to twice the cone of the same base and height. And a cylinder, of the same height and base, being a triple of the cone, it follows, that the hemisphere is two-thirds of the cylinder, and consequently the whole sphere two-thirds of the circumscribing cylinder. Archim. de Sph. et Cycl. Apud Opera per Rivaltum, p. 67.

4. The cube of the diameter of a sphere is to the solid content of the sphere, nearly as 300 to 157: and thus, also, may the content of the sphere be measured.

5. The surface of a sphere is quadruple the area of a circle described with the radius of the sphere. For since a sphere is equal to a pyramid, whose base is the surface, and its altitude the radius of the sphere; the surface of the sphere is had, by dividing its solidity by a third part of its semi-diameter, or one-sixth of the whole diameter.

But the solidity of the sphere is the product of $\frac{2}{3}$ ds of the greatest circle by the diameter; and if this product be divided by $\frac{1}{6}$ th of the diameter, the quotient, or $\frac{1}{3}$ of the greatest circle, *i. e.* four times the greatest circle, will be the surface of the sphere.

Otherwise: the surface of a sphere is equal to the product of its diameter, and the periphery of its generating circle; but the area of this circle is equal to the product of the semi-diameter and half the periphery, or one-fourth of the product of the diameter and periphery; and, therefore, the surface of the sphere is equal to four times the area of its generating circle.

Hence, 6. The surfaces of spheres are to one another as the squares of their diameters; because these surfaces, being four times their generating circles, are as these circles, *i. e.* as the squares of their diameters.

7. Spheres being $\frac{2}{3}$ d parts of cylinders of equal base and altitude, and cylinders being as the cubes of their altitudes, are as the cubes, or in the triplicate ratio of their diameters.

8. The surface of any portion of a sphere, greater or less than the hemisphere, is equal to the area of a circle, whose radius is a line drawn from the vertex of that portion to the circumference of the circle which is its base. Archimedes, *ubi supra*, pp. 84, 85.

SPHERE, the diameter of a, being given, to find its surface and solidity. Find the periphery of the circle described by the radius of the sphere, or of the generating circle.

Multiply this, found, into the diameter, or the square of the diameter, by 3.1416, the product is the surface of the sphere. Multiply the surface by a sixth part of the diameter, or the area of the generating circle by $\frac{2}{3}$ ds of its diameter; or, again (because the area of such circle is to the square of the diameter as .7854 to 1), the cube of the

diameter by .5236 (= $\frac{1}{6}$ of .7854); and the product is the solidity of the sphere.

Thus, supposing the diameter of the sphere 56, the periphery will be found 175.9, which multiplied by the diameter, the product 9852 is the surface of the sphere; which multiplied by $\frac{1}{6}$ th part of the diameter, gives the solidity 91623.6. Or thus:

Find the cube of the diameter 175616; then to 300,157, and the cube found, find a fourth proportional. This is the solidity of the sphere required.

For finding the surface and solidity of the sphere by the method of fluxions, see SUPERFICIES and SOLIDITY. For segments and sectors of spheres, see FRUSTUM, SEGMENT, and SECTOR.

SPHERE, Doctrine of the. See SPHERICS.

SPHERE, Projection of the. See PROJECTION.

SPHERE of Activity. See ACTIVITY.

SPHERE, in Astronomy, that concave orb or expanse which invests our globe, and in which the heavenly bodies, *viz.* sun, stars, planets, and comets, appear to be fixed at an equal distance from the eye.

This is also called the *sphere of the world*; and is the subject of the spherical astronomy.

This sphere, as it includes the fixed stars, whence we also occasionally call it the *sphere of the fixed stars*, is immensely great. The diameter of the earth's orbit is so small, in respect to the diameter of this, that the centre of the sphere is not sensibly changed by any alteration of the spectator's place in the several parts of the orbit; but still, in all the points of the earth's surface, and at all times, the inhabitants have the same appearance of the sphere; that is, the fixed stars seem to possess the same points in the surface of the sphere. For our way of judging of the places, &c. of the stars, is to conceive right lines drawn from the eye, or the centre of the earth, through the centre of the stars, and continued thence till they cut the foresaid sphere; the points where these lines terminate in it are the apparent places of those stars.

The better to determine the places of the heavenly bodies in the sphere, several circles are imagined to be described in the surface thereof, hence called *circles of the sphere*.

SPHERE, in Geography, &c. denotes a certain disposition of the circles on the surface of the earth, with regard to one another, which varies in various parts of it.

The circles originally conceived on the surface of the sphere of the world, are almost all transferred, by analogy, to the surface of the earth, where they are conceived to be drawn directly underneath those of the sphere, or in the same planes with them; so that, if the planes of those of the earth were continued to the sphere, they would coincide with the respective circles upon it. Thus we have an horizon, meridian, equator, &c. on the earth.

As the equator in the heavens divides the sphere into two equal parts, the one north, and the other south, so does the equator on the surface of the earth divide the globe in the same manner.

And as the meridians in the heavens pass through the poles of the horizon, so do those of the earth, &c.

With regard, then, to the position of some of the circles in respect of others, we have a right, a parallel, and an oblique sphere.

SPHERE, Armillary, or Artificial, is an astronomical instrument, representing the several circles of the sphere in their natural order; serving to give an idea of the office and position of each of them, and to solve various problems relating to them.

It is thus called, as consisting of a number of fasciæ or rings

SPHERE.

rings of brass, or other matter, called by the Latins *armillæ*, from their resemblance to bracelets, or rings for the arm.

By this it is distinguished from the globe, which, though it hath all the circles of the sphere on its surface; yet is not cut into armillæ or rings, to represent the circles simply and alone; but exhibits also the intermediate spaces between the circles.

SPHERE, *The Armillary*, of Mr. Ferguson, constructed after the model of the glass sphere of Dr. Long, is represented *Plate XX. Astronomy, fig. 5.*

The exterior parts of this machine are a compages of brass rings, which represent the principal circles of the heavens, *viz.* 1. The equinoctial A A, which is divided into 360 degrees (beginning at its intersection with the ecliptic in Aries), for shewing the sun's right ascension in degrees; and also into twenty-four hours, for shewing his right ascension in time. 2. The ecliptic B B, which is divided into 12 signs, and each sign into 30 degrees, and also into the months and days of the year, in such a manner, that the degree or point of the ecliptic in which the sun is, on any given day, stands over that day in the circle of months. 3. The tropic of Cancer C C, touching the ecliptic at the beginning of Cancer in *e*; and the tropic of Capricorn D D, touching the ecliptic at the beginning of Capricorn in *f*; each $23\frac{1}{2}$ degrees from the equinoctial circle. 4. The arctic circle E, and the antarctic circle F, each $23\frac{1}{2}$ degrees from its respective pole at N and S. 5. The equinoctial colure G G, passing through the north and south poles of the heaven at N and S, and through the equinoctial points Aries and Libra, in the ecliptic. 6. The solstitial colure H H, passing through the poles of the heaven, and through the solstitial points Cancer and Capricorn, in the ecliptic. Each quarter of the former of these colures is divided into 90 degrees, from the equinoctial to the poles of the world, for shewing the declination of the sun, moon, and stars: and each quarter of the latter, from the ecliptic at *e* and *f*, to its poles *b* and *d*, for shewing the latitudes of the stars.

In the north pole of the ecliptic is a nut *b*, to which is fixed one end of a quadrantal wire, and to the other end a small sun Y, which is carried round the ecliptic B B, by turning the nut: and in the south pole of the ecliptic is a pin at *d*, on which is another quadrantal wire, with a small moon, Z, upon it, which may be moved round by hand: but there is a particular contrivance for causing the moon to move in an orbit which crosses the ecliptic at an angle of $5\frac{1}{2}$ degrees, in two opposite points, called the *moon's nodes*; and also for shifting those points backward in the ecliptic, as the moon's nodes shift in the heaven.

Within these circular rings is a small terrestrial globe I, fixt on an axis K K, which extends from the north and south poles of the globe at *n* and *s*, to those of the celestial sphere at N and S. On this axis is fixt the flat celestial meridian L L, which may be set directly over the meridian of any place on the globe, and then turned round with the globe, so as to keep over the same meridian upon it. This flat meridian is graduated the same way as the brass meridian of the common globe, and its use is much the same. To this globe is fitted the moveable horizon M M, so as to turn upon two strong wires proceeding from its east and west points to the globe, and entering the globe at opposite points of its equator, which is a moveable brass ring let into the globe in a groove all round its equator. The globe may be turned by hand within this ring, so as to place any given meridian upon it, directly under the celestial meridian L L. The horizon is divided into 360 degrees all round its outermost edge, within which are the points of the compass, for shewing the amplitude of the sun and

moon, both in degrees and points. The celestial meridian L L passes through two notches in the north and south points of the horizon, as in a common globe: but here, if the globe be turned round, the horizon and meridian turn with it. At the south pole of the sphere is a circle of 24 hours, fixt to the rings, and on the axis is an index which goes round that circle, if the globe be turned round its axis.

The whole fabric is supported on a pedestal N, and may be elevated or depressed upon the joint O, to any number of degrees from 0 to 90, by means of the arc P, which is fixed into the strong brass arm Q, and slides into the upright piece R, in which is a screw at *r*, to fix it at any proper elevation.

In the box T are two wheels (as in Dr. Long's sphere), and two pinions, whose axes come out at V and U; either of which may be turned by the small winch W. When the winch is put upon the axis V, and turned backward, the terrestrial globe, with its horizon and celestial meridian, keep at rest; and the whole sphere of circles turns round from east, by south, to west, carrying the sun Y, and the moon Z, round the same way, and causing them to rise above and set below the horizon. But when the winch is put upon the axis U, and turned forward, the sphere with the sun and moon keep at rest; and the earth, with its horizon and meridian, turn round from west, by south, to east; and bring the same points of the horizon to the sun and moon, to which these bodies came when the earth kept at rest, and they were carried round it; shewing that they rise and set in the same points of the horizon, and at the same times in the hour-circle, whether the motion be in the earth or in the heaven. If the earthly globe be turned, the hour-index goes round its hour-circle; but if the sphere be turned, the hour-circle goes round below the index.

And so, by this construction, the machine is equally fitted to shew either the real motion of the earth, or the apparent motion of the heaven.

To rectify the sphere for use, first slacken the screw *r* in the upright stem R, and taking hold of the arm Q, move it up or down until the given degree of latitude for any place be at the side of the stem R; and then the axis of the sphere will be properly elevated, so as to stand parallel to the axis of the world, if the machine be set north and south by a small compass: this done, count the latitude from the north pole, upon the celestial meridian L L, down towards the north notch of the horizon, and set the horizon to that latitude; then turn the nut *b* until the sun Y comes to the given day of the year in the ecliptic, and the sun will be at its proper place for that day: find the place of the moon's ascending node, and also the place of the moon, by an Ephemeris, and set them right accordingly: lastly, turn the winch W, until either the sun comes to the meridian L L, or until the meridian comes to the sun (according as you want the sphere or earth to move), and set the hour-index to the XII, marked noon, and the whole machine will be rectified. Then turn the winch, and observe when the sun or moon rise and set in the horizon, and the hour-index will shew the times of them for the given day. See Ferguson's *Lectures*, p. 194, &c.

Armillary spheres are of different kinds with regard to the position of the earth in them; whence they become distinguished into *Ptolemaic* and *Copernican* spheres: in the first of which the earth is in the centre, and in the latter near the circumference, according to the position which that planet obtains in those systems.

SPHERE, *The Ptolemaic*, is that commonly in use, and is represented (*Plate XX. Astronomy, fig. 6.*) with the names of

of the several circles, lines, &c. of the sphere, inscribed on them. In the middle, upon the axis of the sphere, is a ball, T, representing the earth, on whose surface are the circles, &c. of the earth. The sphere is made to revolve about the said axis, which remains at rest; by which means the sun's diurnal and annual course about the earth are represented according to the Ptolemaic hypothesis; and even by means of it, all problems relating to the phenomena of the sun and earth are solved, as upon the celestial globe, and after the same manner, which see described under GLOBE.

SPHERE, *The Copernican*, (represented *Plate XX. Astronomy, fig. 7.*) is very different from the Ptolemaic, both in its constitution and use; and is more intricate in both. Indeed, the instrument is in the hands of so few people, and its use so incon siderable, except what we have in the other more common instruments, particularly the globe and Ptolemaic sphere, that we shall be easily excused the not taking up room with any description of it.

SPHERES, *Harmony of the*. See HARMONY.

SPHERES, *Obliquity of the*. See OBLIQUITY.

SPHERE, *Rectifying of the*. See RECTIFYING.

SPHERE, *Dialling*. See DIALLING.

SPHERES, polished spherical masses of a mixed metalline composition, used in optics. The manner of making them is as follows.

Take of pure tin, three pounds; copper, one pound; melt these two metals together, and when in fusion cast upon the mass six ounces of burnt tartar, and an ounce and half of saltpetre; and lastly, a quarter of an ounce of alum, and two ounces of arsenic: let all these matters evaporate and burn away, and then cast the pure metal into the figure of a sphere, and it will be capable of a high and elegant polish. *Neri's Art of Glass*, p. 166. See *STEEL-Glasses*.

SPHERICAL ANGLE, is the mutual inclination of two planes, by which a sphere is cut.

Thus, the inclination of the two planes C A F and C E F, (*Plate II. Trigonometry, fig. 1.*) forms the spherical angle A C E.

The measure of a spherical angle, A C E, is an arc of a great circle A E, described from the vertex C, as from a pole, and intercepted between the legs C A and C E.

Hence, 1. Since the inclination of the plane C E F to the plane C A F is every where the same, the angles in the opposite intersections, C and F, are equal.

2. Hence the measure of a spherical angle A C E is described by the interval of a quadrant A C or E C from the vertex C, between the legs C A, C E.

If a circle of the sphere A E B F (*fig. 2.*) cut another, C E D F, the adjacent angles, A E C and A E D, are equal to two right ones; and the vertical angles, A E C and D E B, are equal to one another. The former likewise holds of several angles formed on the same arc C E D, at the same point E. Hence, any number of spherical angles, as A E C, A E D, D E B, B E C, &c. made on the same point E, are equal to four right angles. See *SPHERICAL Triangle*.

SPHERICAL Triangle, a triangle comprehended between three arcs of great circles of a sphere, intersecting each other in its surface.

SPHERICAL Triangles, Properties of. 1. If in two spherical triangles (*Plate II. Trigonometry, fig. 3.*) A B C and a b c, A = a, B A = b a, and C A = c a; then will B, b, and the sides including the angles, be respectively equal; the whole triangles are equal: that is, B C = b c, B = b, and C = c.

Again, if in two spherical triangles A = a, C = c, and A C = a c; then will B = b, A B = a b, and B C = b c.

Lastly, if in two spherical triangles A B = a b, A C =

a c, and B C = b c; then will A = a, B = b, and C = c: the demonstrations of which coincide with those of the like properties in plain triangles; the theorems of the congruency of rectilinear triangles extending to all other curvilinear, circular, parabolical, &c. provided their sides be similar. See **TRIANGLE**.

2. In an equicrural triangle A B C (*fig. 4.*) the angles at the base, B and C, are equal; and if in any triangle, the angles B and C, at the base B C, are equal, the triangle is equicrural.

3. In every spherical triangle, each side is less than a semicircle: any two sides taken together are greater than the third; and all the three sides together are less than the periphery of a great circle; and a greater side is always opposed to a greater angle, and a less side to a less angle.

4. If in a spherical triangle B A C (*fig. 5.*) two legs, A B and B C, taken together, be equal to a semicircle; the base A C being continued to D; the external angle B C D will be equal to the internal opposite one B A C. If the two legs together be less than a semicircle, the external angle B C D will be greater than the internal opposite one A; and if the legs be greater than a semicircle, the external angle B C D will be less than the internal opposite one A; and the reverse of all these holds, viz. if the angle B C D be equal to, greater, or less, than A, the sides A B and B C are equal to, greater, or less, than a semicircle.

5. If in a spherical triangle A B C, two sides, A B and B C, be equal to a semicircle, the angles at the base, A and C, are equal to two right ones: if the sides be greater than a semicircle, the angles are greater than two right ones; and if less, less; and conversely.

6. In every spherical triangle, each angle is less than two right ones; and the three together are less than six right angles, and greater than two.

7. If in a spherical triangle B A C (*fig. 5.*) the sides A B and A C be quadrants, the angles at the base, B and C, will be right angles. And if the intercepted angle A be a right angle, B C will be a quadrant: if A be obtuse, B C will be greater than a quadrant; and if acute, less; and conversely.

8. If in a spherical rectangular triangle, the side B C (*fig. 6.*) adjacent to the right angle B, be a quadrant, the angle A will be a right angle; if B E be greater than a quadrant, the angle A will be obtuse; and if B D be less than a quadrant, the angle A will be acute; and conversely.

9. If in a spherical rectangular triangle, each leg be either greater or less than a quadrant, the hypotenuse will be less than a quadrant; and conversely.

10. If in a spherical triangle A B C (*fig. 7.*) rectangular only at B, one side, C B, be greater than a quadrant, and the other side, A B, less, the hypotenuse, A C, will be greater than a quadrant; and conversely.

11. If in a spherical oblique-angular triangle A C B (*fig. 8.*) both angles at the base, A and B, be either obtuse or acute; the perpendicular C D, let fall from the third angle C, to the opposite side A B, falls within the triangle: if one of them, A, be obtuse, and the other, B, acute, the perpendicular falls without the triangle.

12. If in a spherical triangle A C, all the angles, A, B, and C, be acute, the sides are each less than a quadrant. Hence, if in an oblique-angular spherical triangle, one side be greater than a quadrant, one angle is obtuse, viz. that opposite to this side.

13. If in a spherical triangle A C B, two angles, A and B, be obtuse, and the third, C, acute; the sides, A C and C B, opposite to the obtuse angles are greater than a quadrant; and that opposite to the acute angle, A B, is less than

a quadrant. Hence, if the two sides be less than a quadrant, the two angles are acute.

14. If in a spherical triangle the several sides be each greater than a quadrant; or only two of them greater, and the third be equal to a quadrant, the several angles are obtuse.

15. If in an oblique-angular spherical triangle two sides be less than a quadrant, and the third greater; the angle opposite to the greatest will be obtuse, and the rest acute.

Spherical Triangles, Resolution of. See TRIANGLE.

Spherical Astronomy, that part of astronomy which considers the universe such as it appears to the eye. See ASTRONOMY.

Under spherical astronomy, then, are comprehended all the phenomena and appearances of the heavens and heavenly bodies, such as we perceive them, without any enquiry into the reason, the theory, or the truth of them. By which it is distinguished from *theoretical astronomy*, which considers the real structure of the universe, and the causes of those phenomena.

In the spherical astronomy, the world is conceived to be a concave spherical surface, in whose centre is the earth, or rather the eye, about which the visible frame revolves, with stars and planets fixed in its circumference. And on this supposition all the other phenomena are determined.

The theoretical astronomy teaches us, from the laws of optics, &c. to correct this scheme, and reduce the whole to a juster system.

Spherical Compasses. See COMPASSES.

Spherical Excess, in *Trigonometry*, is the excess of the sum of the three angles of any spherical triangle above three right angles; which excess in seconds, multiplied by the radius of the sphere, is equal to the area of the triangle, as was first shewn by Albert Girard.

It is extremely desirable, in geodetic operations, to be able to ascertain the spherical excess from other principles than those of the observed angles; these being very subject to small inaccuracies, from the effect of refraction near the horizon: and nothing seems better calculated for this purpose, than the foregoing property of the area of the triangle; for this being, as we have stated above, equal to the excess multiplied by the radius of the sphere, therefore, conversely, the area being known or computed on other principles, the excess may thence be determined, and the accuracy of the observed angles submitted to the test thence obtained. Now as such triangles as occur, even in the most extensive surveys, differ but little from rectilinear ones, their areas may be computed as if they really were such, with scarcely any perceptible error; and hence this important object is at once obtained.

The application of Albert Girard's theorem was first made by general Roy, or rather by Mr. Dalby, his assistant, and published in the Philosophical Transactions for 1790, p. 171, where we have the following rule: "From the area of the logarithms of the triangle, computed as a plane one, in feet, subtract the constant logarithm 9.3267737, and the remainder is the logarithm of the excess above 180° in seconds nearly." This rule is very general, and, being the first application of this principle to geodetic computations, is highly creditable to its inventor; but it is not always the most concise; and other rules have since been given by different authors, which are applicable to every variety of data. We can, however, in this place only enumerate some of the principal ones, and must refer the reader for their investigations to the works from which they have been selected.

1. The spherical excess may be found in seconds by the

expression $E = \frac{R''S}{r}$; where E is the excess; S is the surface of the triangle $= \frac{1}{2} bc \cdot \sin. A = \frac{1}{2} ab \cdot \sin. C = \frac{1}{2} ac \cdot \sin. B = \frac{1}{2} a^2 \frac{\sin. B \cdot \sin. C}{\sin. (B + C)}$; r is the radius of the

earth, in the same measure as a, b, c, the sides of the triangle; and $R'' = 206264''\cdot8$, the seconds in an arc equal in length to the radius.

If this rule be applied logarithmically, then $\log. R'' = \log. \frac{r}{\text{arc } r''} = 5\cdot3144251$.

2. Hence is readily deduced general Roy's rule, as above given, viz.

$$\log. E'' = \log. (\text{area in feet}) - 9\cdot3267737.$$

3. Since $S = \frac{1}{2} bc \cdot \sin. A$, we shall manifestly have $E = \frac{R''}{2r^2} bc \cdot \sin. A$. Hence, if from the vertical angle

B, of a spherical triangle ABC, we demit the perpendicular BD, upon the base AC, dividing it into two segments α and β , we shall have $b = \alpha + \beta$; and hence,

$$E = \frac{R''}{2r^2} c (\alpha + \beta) \sin. A \\ = \frac{R''}{2r^2} \alpha c \sin. A + \beta c \sin. A.$$

But the two right-angled triangles being in all practical cases nearly rectilinear, gives $\alpha = a \text{ cof. } C$, and $\beta = c \text{ cof. } A$; whence we have

$$E = \frac{R''}{2r^2} ac \sin. A \cdot \text{cof. } C + \frac{R''}{2r^2} c^2 \sin. A \text{ cof. } A.$$

In like manner, the triangle ABC, which is itself so small as to differ but a little from a plane triangle, gives $c \sin. A = a \sin. C$, also $\sin. A \cdot \text{cof. } A = \frac{1}{2} \sin. 2A$, and $\sin. C \cdot \text{cof. } C = \frac{1}{2} \sin. 2C$; therefore, finally,

$$E = \frac{R''}{4r^2} a^2 \cdot \sin. 2C + \frac{R''}{4r^2} c^2 \sin. 2A.$$

From which theorem a table may be formed, whence the spherical excess may be found; entering the table with each of the sides above the base and its adjacent angle as arguments.

4. If the base b, and height h, of the triangle be given, then we have evidently $E = \frac{1}{2} bh \frac{R''}{r^2}$. Hence results

the following simple logarithmic rule: Add the logarithm of the base of the triangle, taken in feet, to the logarithm of the perpendicular, taken in the same measure, and deduct from the sum the constant log. 9.6278037; and the remainder will be the common logarithm of the spherical excess in seconds and decimals.

5. Again, when the three sides of the triangle are given, then

$$\log. E = \frac{1}{2} (\log. s + \log. (s - a) + \log. (s - b) + \log. (s - c)) - 9\cdot3267737;$$

where $s = \frac{1}{2}$ sum of the sides, or $s = (a + b + c) \div 2$.

The two latter formulae are in fact only particular cases of Roy's general theorem.

6. When any two sides, *a*, *b*, and their contained angle *C*, are given, then we have

$$\cot. \frac{1}{2} E = \frac{\cot. \frac{1}{2} a \cdot \cot. \frac{1}{2} b + \cot. C}{\sin. C}$$

7. When the three sides are given, we may also, instead of the formula in art. 5, make use of the following elegant theorem, discovered by Simon L'Hullier, viz.

$$\tan. \frac{1}{4} E = \sqrt{\left(\tan. \frac{a+b+c}{4} \cdot \tan. \frac{a+b-c}{4} \cdot \tan. \frac{a-b+c}{4} \cdot \tan. \frac{-a+b+c}{4} \right)}$$

One or other of these rules will apply to all cases in which the spherical excess will be required.

We shall conclude this short article with one or two examples of its application, as given by general Roy, Phil. Transf. 1790, p. 172.

Names of Stations.	Observed Angles.
Hanger-hill Tower (a)	42° 2' 32"
Hampton Poor-house (b)	67 55 39
King's Arbour (c)	70 1 48
	<hr/>
	179 59 59

Distance in Feet.

$$\begin{aligned} (a) \text{ from } (b) &= 38461.12 \\ (a) \text{ from } (c) &= 27404.7 \end{aligned}$$

Hence, making the distance from (a) to (c) the base of the triangle, the perpendicular on that base will be equal to $38461.12 \times \sin. 42^\circ 2' 32''$; and, therefore, the area of the triangle =

$$\frac{\text{base} \times \text{perp.}}{2} = 24704.7 \times 19230.56 \times \sin. 42^\circ 2' 32''.$$

Computation.

Log. sin. 42° 2' 32"	=	9.8258661
Log. 24704.7	=	4.3927761
Log. 19230.56	=	4.2839906
		<hr/>
		18.5026328

Taking away 10 for radius, we have 8.5026328 for the log. of the area in feet.

Whence from	-	-	8.5026328
Take const. log.	-	-	9.3267737
			<hr/>
Corresp. numb. .14992	-	-	1.7158591

Whence the spherical excess in seconds is .14992", or 6".15 nearly.

Again, as a second example.

Names of Stations.	Observed Angles.
Hundred Acres (d)	53° 58' 35".75
Hanger-hill Tower (e)	68 24 44
St. Anne's Hill (f)	57 36 39.5
	<hr/>
	179 59 59.25

Distance in Feet.

$$\begin{aligned} (d) \text{ from } (e) &= 71934.2 \\ (d) \text{ from } (f) &= 79211.22 \end{aligned}$$

Log. sin. 53° 58' 35".75	=	9.9078237
Log. 35967.1	=	4.5559054
Log. 79211.22	=	4.8987866

Sum minus radius	=	9.3625207
Subtract const. log.	=	9.3267737

$$\text{Corresp. numb. 1.0858} = 0.0357470$$

Whence the spherical excess is 1".0858.

In this manner the computed spherical excess will enable the observer to examine the accuracy of his observations, and in some degree to correct them; after which he may proceed to calculate the sides of the triangles by the rules of spherical trigonometry, or by Legendre's theorem, viz. "a spherical triangle being proposed, of which the sides are very small, relatively to the radius of the sphere; if, from each of the angles, one-third of the excess of the sum above two right angles be subtracted, the angles so diminished may be taken for the angles of a rectilinear triangle, the sides of which are equal in length to those of the proposed spherical triangle."

SPHERICAL Geometry, the doctrine of the sphere; particularly of the circles described on the surface thereof, with the method of projecting the same on a plane; and measuring their arcs and angles when projected.

SPHERICAL Numbers. See CIRCULAR Numbers.

SPHERICAL Trigonometry. See SPHERICAL TRIGONOMETRY.

SPHERICITY, the quality of a sphere; or that by which a thing becomes spherical or round.

The sphericity of pebbles, fruits, berries, &c. as also of drops of water, quicksilver, &c. and of bubbles of air under water, &c. Dr. Hook takes to arise from the incongruity of their particles with those of the ambient fluid, which prevents their coalescing; and by pressing on them, and encompassing them all round equally, turns them into a round form.

This, he thinks, appears evidently from the manner of making small round shot of several sizes, without casting the lead into any moulds; from drops of rain being formed, in their fall, into round hail-stones; and from drops of water falling on small dust, sand, &c. which soon produce an artificial round mass; and from the small, round, red-hot balls, formed by the collision or fusion of flint and steel, in striking fire.

But all these cases of sphericity seem better accounted for from the great principle of attraction; by which the parts of the same fluid drop, &c. are all naturally ranged as near the centre as possible, which necessarily induces a spherical figure; and, perhaps, a repelling force between the particles of the drop, and of the medium, contributes also not a little thereto. See ATTRACTION and COHESION.

SPHERICS, the doctrine of the sphere, particularly of the several circles described on its surface; with the method of projecting the same in plano.

The principal matters shewn here are as follow:

1. If a sphere be cut in any manner, the plane of the section will be a circle, whose centre is in the diameter of the sphere.

Hence, 1. The diameter HI (Plate II. Trigonometry, fig. 9.) of a circle, passing through the centre C, is equal

to the diameter A B of the generating circle; and the diameter of a circle, as F E, that does not pass through the centre, is equal to some chord of the generating circle.

Hence, 2. As the diameter is the greatest of all chords, a circle passing through the centre is the greatest circle of the sphere; and all the rest are less than the same.

Hence also, 3. All great circles of the sphere are equal to one another.

Hence also, 4. If a great circle of the sphere passes through any given point of the sphere, as A, it must also pass through the point diametrically opposite to it, as B.

Hence also, 5. If two great circles mutually intersect each other, the line of section is the diameter of the sphere; and therefore two great circles intersect each other in points diametrically opposite.

Hence also, 6. A great circle of the sphere divides it into two equal parts or hemispheres.

2. All great circles of the sphere cut each other into two equal parts; and, conversely, all circles that thus cut each other are great circles of the sphere.

3. An arc of a great circle of the sphere, intercepted between another arc H I L (*fig. 10.*), and its poles A and B, is a quadrant. That intercepted between a less circle D E F, and one of its poles A, is greater than a quadrant; and that between the same, and the other pole B, less than a quadrant; and conversely.

4. If a great circle of the sphere passes through the poles of another, that other passes through the poles of this. And if a great circle passes through the poles of another, the two cut each other at right angles; and conversely.

5. If a great circle, as A F B D, passes through the poles A and B of a lesser circle D E F, it cuts it into equal parts, and at right angles.

6. If two great circles, A E B F and C E D F, (*fig. 11.*) intersect each other in the poles E and F of another great circle A C B D; that other will pass through the poles I and i, H and h, of the circles A E B F and C E D F.

7. If two great circles, A E B F and C E D F, cut each other mutually; the angle of obliquity, A E C, will be equal to the distance of the poles H, I.

8. All circles of the sphere, as G F and L K (*fig. 12.*) equally distant from its centre C, are equal; and the farther they are removed from the centre, the less they are. Hence, since of all parallel chords, only two, G F and L K, are equally distant from the centre; of all the circles parallel to the same great circle, only two are equal.

9. If the arcs F H and K H, and G I and I L, intercepted between a great circle I M H, and the lesser circles G N F and L O K, be equal, the circles are equal.

10. If the arcs F H and G I, of the same great circle A I B H, intercepted between two circles G N F and I M H, be equal, the circles are parallel.

11. An arc of a parallel circle, I G, (*fig. 1.*) is similar to an arc of a great circle, A E; if each be intercepted between the same great circles C A F and C E F.

Hence, the arcs A E and I G have the same ratio to their peripheries; and, consequently, contain the same number of degrees. And hence the arc I G is less than the arc A E.

12. The arc of a great circle is the shortest line which can be drawn from one point of the surface of the sphere to another; and the lines between any two points on the same surface are the greater, as the circles of which they are arcs are the less.

Hence, the proper measure, or distance, of two places on the surface of the sphere, is an arc of a great circle inter-

cepted between the same. See more on this subject in Theodosii Elem. Sphær. apud Dechales Curfus Mathematicæ, tom. i. p. 145, &c.

SPHEROID, ΣΦαιροειδης, formed from σφαιρα, *sphæra*, and εἶδος, *shape*, in *Geometry*, a solid approaching to the figure of a sphere, though not exactly round, but oblong; as having one of its diameters bigger than the other; and generated by the revolution of a semi-ellipsis about its axis.

When it is generated by the revolution of the semi-ellipsis about its greater or transverse axis, it is called an *oblong* or *prolate spheroid*: and when generated by the revolution of an ellipsis about its less or conjugate axis, an *oblate spheroid*.

The contour of a dome, Daviler observes, should be half a spheroid. Half a sphere, he says, is too low to have a good effect below.

For the solid dimension of a spheroid, multiply continually together the fixed axis, the square of the revolving axis, and the number .52359877, or $\frac{1}{2}$ of 3.14159, and the last product will be the solidity: *i. e.* $\frac{1}{2} p t t c$ = the oblate, and $\frac{1}{2} p t c c$ = the oblong spheroid, where $p = 3.14159$, t = the transverse, and c = the conjugate axis of the generating ellipsis. Or, multiply the area of the generating ellipsis by $\frac{2}{3}$ of the revolving axis, and the product will be the content of the spheroid: *i. e.* $\frac{2}{3} t A$ = the oblate, and $\frac{2}{3} c A$ = the oblong spheroid; where A is the area of the ellipsis. *E. g.* Required the content of an oblate, and of an oblong spheroid, the axes being 50 and 30. Thus, $50 \times 30 \times .78539816 = 1178.09724$ = the area of the ellipsis. And $1178.09724 \times \frac{2}{3} \times 30 = 23561.9448$ = the oblong spheroid: and $1178.09724 \times \frac{2}{3} \times 50 = 39269.908$ = the oblate one.

Dr. Hutton has demonstrated the rule above given in the following manner. Put $f = B I$ the fixed semi-axis, (*Plate XIV. Geometry, fig. 3.*) $r = I M$ the revolving semi-axis of the spheroid, $a = S I$ any semi-diameter of the section N B M, $b = I K$ its semi-conjugate, $y = A E$ an ordinate to the diameter S I, or a semi-axis of the elliptic section A F C parallel to K L, and $z = E F$ its other semi-axis, also $x = E I$, s = the sine of the angle A E S, or of the angle K I S, to the radius 1, and $p = 3.14159$.

Then, by the property of the ellipse K S L, $aa : bb$

$$:: aa - xx : bb \times \frac{aa - xx}{aa} = yy; \text{ and } b : r :: y : \frac{ry}{b}$$

= z. But the fluxion of the solid K A C L is $psyz \dot{x}$

$$= \frac{psryy \dot{x}}{b}, \text{ by writing for } z \text{ its value } \frac{ry}{b}, = pbsr \dot{x} \times$$

$$\frac{aa - xx}{aa}, \text{ by substituting for } yy \text{ its value } bb \times \frac{aa - xx}{aa},$$

$$= pfr r \dot{x} \times \frac{aa - xx}{aaa}, \text{ by putting for } abs \text{ its value } rf;$$

$$\text{and hence the fluent } pfr r x \times \frac{aa - \frac{1}{2}xx}{aaa}, \text{ or } \frac{1}{2} pfr r x$$

$$\frac{3aa - xx}{aaa}, \text{ will be the value of the frustum K A C L;}$$

which, when E I or x becomes S I or a, gives $\frac{1}{2} pfr r$ for the value of the semi-spheroid K S L; or the whole spheroid = $\frac{1}{2} p F R R$, putting F and R for the whole fixed and revolving axes. Q.E.D.

Corol. 1.—From the foregoing demonstration it appears that

SPHEROID.

that the value of the general frustum K A E C L is expressed by $\frac{1}{2} p f r r x \times \frac{3 a a - x x}{a a a}$.

And if for $f r$ be substituted its value $a b s$, the same frustum will also be expressed by $\frac{1}{2} p b r s x \times \frac{3 a a - x x}{a a}$.

Also, if for $a a$ be put its value $\frac{b b x x}{b b - y y}$, the last expression will become $\frac{1}{2} p r s x \times \frac{2 b b + y y}{b}$, or $\frac{1}{2} p s x \times$

$(2 b r + \frac{r y y}{b})$; which, by writing z instead of its value

$\frac{r y}{b}$, gives $\frac{1}{2} p s x \times (2 b r + y z)$ for the value of the frustum, viz. the sum of the area of the less end, and twice that of the greater, drawn into one-third of the altitude or distance of the ends.

And out of this last expression may be expunged any one of the four quantities b, r, y, z , by means of the proportion $b : r :: y : z$.

When the ends of the frustum are perpendicular to the fixed axis, then a is $= f$, and the value of the frustum becomes $\frac{1}{2} p r r x \times \frac{3 f f - x x}{f f}$ for the value of the frustum whose ends are perpendicular to the fixed axis, its altitude being x .

And when the ends of the frustum are parallel to the fixed axis, a is $= r$, and the expression for such a frustum becomes $\frac{1}{2} p f x \times \frac{3 r r - x x}{r}$.

Corol. 2.—If to or from $\frac{1}{2} p f r r$, the value of the semi-spheroid, be added or subtracted $\frac{1}{2} p f r r x \times \frac{3 a a - x x}{a a a}$, the value of the general frustum K A C L, there will result

$\frac{1}{2} p f r r b b \times \frac{3 a - b}{a a a}$ for the value of a general segment,

either greater or less than the semi-spheroid, whose height, taken upon the diameter passing through its vertex and centre of its base, is $b = a \pm x$.

When a coincides with f , the above expression becomes

$\frac{1}{2} p r r b b \times \frac{3 f - b}{f f}$ for the value of a segment whose base

is perpendicular to the fixed axis.—And here, if we put R for the radius of the segment's base, and for $r r$ its

value $\frac{R R f f}{2 f b - b b}$, the said segment will become $\frac{1}{2} p R R b \times$

$\frac{3 f - b}{2 f - b}$.

And when a coincides with r , the general expression will become $\frac{1}{2} p f b b \times \frac{3 r - b}{r}$ for the value of the segment

whose base is parallel to the fixed axis. And if we put F, R , for the two semi-axes of the elliptic base of this

segment, respectively corresponding or parallel to f, r , the semi-axes of the generating ellipse, when parallel to the

base of the segment, and for $\frac{f}{r}$ and r substitute their

values $\frac{F}{R}$ and $\frac{R R + b b}{2 b}$, the said frustum will be ex-

pressed by $\frac{1}{2} p F b \times \frac{3 R R + b b}{2 R}$, in which the dimensions

of itself only are concerned.

Corol. 3.—A semi-spheroid is equal to $\frac{2}{3}$ ds of a cylinder, or to double a cone of the same base and height; or they are in proportion as the numbers 3, 2, 1. For the cylinder is $= 4 n f r r = \frac{1}{2} n f r r$, the semi-spheroid $= \frac{2}{3} n f r r$, and the cone $= \frac{1}{3} n f r r$.

Corol. 4.—When $f = r$, the spheroid becomes a sphere, and the expression $\frac{2}{3} f n r r$ for the semi-spheroid becomes $\frac{2}{3} n r^3$ for the semi-sphere. And in like manner, f and r being supposed equal to each other in the values of the frustums and segments of a spheroid, in the preceding corollaries, will give the values of the like parts of a sphere.

Corol. 5.—All spheres and spheroids are to each other as the fixed axes drawn into the squares of the revolving axes.

Corol. 6.—Any spheroids and spheres, of the same revolving axis, as also their like or corresponding parts cut off by planes perpendicular to the said common axis, are to one another as their other or fixed axes. This follows from the foregoing corollaries.

Corol. 7.—But if their fixed axes be equal, and their revolving axes unequal, the spheroids and spheres, with their like parts terminated by planes perpendicular to the common fixed axis, will be to each other as the squares of their revolving axes.

Corol. 8.—An oblate spheroid is to an oblong spheroid, generated from the same ellipse, as the longer axis of the ellipse is to the shorter. For, if T be the transverse axis, and C the conjugate; the oblate spheroid will be $= \frac{2}{3} n T^2 C$, and the oblong $= \frac{2}{3} n C^2 T$; and these quantities are in the ratio of T to C .

Corol. 9.—And if about the two axes of an ellipse, be generated two spheres and two spheroids, the four solids will be continual proportionals, and the common ratio will be that of the two axes of the ellipse; that is, as the greater sphere, or the sphere upon the greater axis, is to the oblate spheroid, so is the oblate spheroid to the oblong spheroid, so is the oblong spheroid to the less sphere, and so is the transverse axis to the conjugate. For these four bodies will be as $T^3, T^2 C, T C, C^3$, where each term is to the consequent one as T to C .

To find the content of an universal spheroid, or a solid conceived to be generated by the revolution of a semi-ellipse about its diameter, whether that diameter be one of the axes of the ellipse or not. 1. Divide the square of the product of the axes of the ellipse by the axis of the solid, or the diameter about which the semi-ellipse is conceived to revolve: multiply the quotient by .5236, and

the product will be the content required. That is, $\frac{T^2 C^2}{d}$

$\times .5236 =$ the content; T and C being the transverse and conjugate axes of the ellipse, and d the axis of the solid.

Or, 2. The continual product of .5236, the diameter about which the revolution is made, the square of its conjugate diameter, and the square of the sine of the angle made

made by those diameters, the radius being 1, will be the content. That is, $d e s s \times .5236 =$ the content; c being the conjugate diameter to d , and s the sine of the angle made by the diameters. For the demonstration of this rule, see Hutton, ubi infra.

Hence, if $d = T$, the rule becomes $\frac{1}{2} p T C^2$ for the oblong spheroid: and if $d = C$, it will be $\frac{1}{2} p C T^2$ for the oblate spheroid: and if T , C , and d , be all equal, the rule will be $\frac{1}{2} p d^3$ for the sphere. See MENSURATION. Hutton's Mensuration.

For the method of finding the superficies of a spheroid, see SUPERFICIES; and for the solidity, see SOLIDITY, and the preceding article.

Dr. Halley has demonstrated, that in a sphere, Mercator's nautical meridian line is a scale of logarithmic tangents of the half complements of the latitudes. But as the earth has been found to be a spheroid, this figure will make some alteration in the numbers resulting from Dr. Halley's theorem. Mr. Maclaurin has therefore given us a rule, by which the meridional parts to any spheroid may be found with the same exactness as in a sphere. We have also an ingenious treatise of Mr. Murdoch's on the same subject. See Phil. Trans. N° 219.

Mr. Cotes has also demonstrated the same proposition, Harm. Mens. p. 20, 21. See MERIDIONAL Parts.

SPHEX, in Entomology, a genus of insects of the order Hymenoptera, of which the generic character is as follows. The mouth is formed with an entire jaw; the mandibles are horny, incurved, and toothed; the lip is horny and membranaceous at the tip; it has four feelers; the antennæ have about ten articulations; the wings in each sex are plane, incumbent, and not folded; the sting is pungent, and concealed within the abdomen. The insects of this genus are said to be the most savage and rapacious of this class of beings: they attack whatever comes in their way, and by means of a poisonous sting, overcome and devour others far beyond their own size. Those of division B, hereafter to be described, are found chiefly on umbellate plants; the larvæ are without feet, soft, and inhabit the body of some insect, on whose juices they exult; the pupa has rudiments of wings.

"As the insects," says Dr. Shaw, "of the genus Ichneumon deposit their eggs in the bodies of other living insects, so those of the genus SpheX deposit their's in dead ones, in order that the young larvæ, when hatched, may find their proper food." There are more than a hundred species of the genus SpheX, which are separated into divisions.

Species.

A. Antennæ setaceous; Lip entire; and no Tongue.

APPENDIGASTER. This species is black; the abdomen is petiole, very short, and placed on the back of the thorax; the hind-legs are very long. This is found in divers parts of Europe, Africa, and New Holland.

*MACULATA. Thorax spotted; first segment of the abdomen with a white dot on each side; the second is edged with white. It is, as the asterisk denotes, an English insect. There is a specimen of it in sir Joseph Banks's museum.

FASCIATA. Black; abdomen with two white bands, the first interrupted; and the tail is white. It is found in different parts of Italy. The thorax is black, covered with silvery down on the fore-part; the fore-margin is marked with a white line; the wings are white, but tipped with brown.

SESSILIS, so named on account of its short, cylindrical, sessile abdomen. The insect is black. It inhabits France; is very like the *S. appendigaster*.

PUNCTUM. This is black; but the tail is marked with a white dot. It is an Italian insect.

NIGRITIA. This also is black; the upper wings are marked with a brown band.

B. *Antennæ filiform; Lip emarginate; with a Bristle on each side; the Tongue is inflexed and trifid.*

Of this section there are two subdivisions; the one has a petiolate abdomen, that of the other is sessile.

a. Abdomen petiolate.

LUTARIA. Black; second and third segments of the abdomen rufous; the lip is silvery. It inhabits Kiel.

THOMÆ. Black; abdomen rufous; the petiole, and spot on the back, black. It inhabits St. Thomas's island.

FERVENS. This is likewise black; the abdomen is ferruginous; the wings are brown. It inhabits India.

CYANIPENNIS. Villous, blue; fore-part of the thorax and abdomen grey; the wings are blue. It inhabits Cayenne, and is large. This is a very beautiful insect; the head is blue; the mandibles and antennæ are black; the abdomen blueish-grey; the petiole black; legs black; the joints yellowish.

HÆMORRHOIDALIS. Black; lip, tail, and legs, ferruginous. Inhabits Africa. A specimen is preserved in the museum of sir Joseph Banks.

ARGENTEA. Glossy-black; front villous, silvery; the wings are white, but tipped with brown. It inhabits Comandel, and is a large insect.

RUFIPENNIS. Black; wings ferruginous, tipped with brown. It inhabits Tranquebar, and is large.

FLAVIPENNIS. Black; front golden; abdomen rufous; the petiole and tips are black. It inhabits Italy.

PENNSYLVANICA. This is of a blackish hue; the abdomen is of a full black; but the wings are inclining to a violet. It inhabits America and New Holland.

VIOLACEA. Blue; wings white, tipped with brown; the antennæ are black. It is found at the Cape of Good Hope.

CYANEA. Blue; wings azure, tipped with brown; the antennæ are black. It inhabits North America.

AURULEATA. Head and thorax covered with gold down; the abdomen is black; the base and legs rufous. It is an inhabitant of Tranquebar.

TOMENTOSA. The head and thorax of the insects of this species are covered with a gold down; the abdomen is black; the base and legs are rufous. It inhabits Sierra Leone.

FEMORATA. This is blue; the abdomen is black; the hind-thighs are rufous. It inhabits Italy.

TIBIALIS. Hairy, black-blue; hind-thighs ferruginous; wings black. It inhabits the Cape of Good Hope. A specimen is preserved in the museum of sir Joseph Banks.

FLAVIPES. Villous, black, with a yellow dot before the wings; the legs are yellow; the thighs black. It inhabits America.

ATRA. This is quite black, excepting the lip, which is silvery villous; wings as long as the abdomen. It inhabits Italy.

FIGULUS. Smooth, black; segments of the abdomen at the edges and lip lucid. It inhabits Upsal, in the holes and crevices of wooden partitions, abandoned by all other insects. According to Dr. Shaw, this insect, when it has found a convenient cavity for the purpose, seizes on a spider,

spider, which it kills, and deposits it at the bottom; then laying her egg in it, she closes up the orifice of the cavity with clay; the larva, which resembles the maggot of a bee, having devoured the spider, spins itself up a dusky silken web, and changes into a chrysalis, out of which, within a certain number of days, proceeds a complete insect, which is black, with a slightly foot-stalked abdomen, the edges of the several segments being of a brighter appearance than the rest of the body. The female of this species prepares several separate holes, or nets, in each of which she places a dead insect and an egg; each cell costing her the labour of about two days.

LUNATA. The abdomen of this insect is black; the first segment is marked with a yellow lunule. It inhabits America, as does the next.

AFFINIS. Villous, black; the first joint of the antennæ, scutell, and shanks, are yellow.

JAMAICENSIS. This, as its name implies, is found in Jamaica. The abdomen is black; the first segment, and edge of the others, are yellow.

ERYTHROCEPHALA. Black; head, base of the petiole, and legs, ferruginous. It inhabits Malabar. A specimen is kept in the museum of Sir Joseph Banks.

* **SPIRIFEX.** Black; thorax hairy, and immaculate; petiole of one joint, yellow; as long as the abdomen. There is a variety, of which the petiole and joints of the legs are half yellow. It is found in this country, in divers parts of Europe, and also in Africa, particularly in Egypt, in cylindrical cavities wrought within like a honey-comb, on the sides of cliffs, and in the mud walls of cottages.

MADRASPATANA. Black; thorax hairy, and spotted with yellow; the petiole is yellow, and as long as the abdomen. It inhabits Malabar.

CLAVUS. Black; thorax spotted; abdomen blueish; the petiole long, rufous, with a black band. This is an inhabitant of New Holland.

HOLOSERICEA. Black, with a silvery down; abdomen ferruginous; the petiole is black, and the tail blue. It is found in Barbary.

PUBESCENS. Black, with silvery down; the abdomen is ferruginous, with a black petiole. It inhabits Guinea, and is found among the grass.

CINCTA. Black, with silvery down; the segments of the abdomen are edged with white. This, like the last, is found in Guinea.

LOBATA. Green-blue; thorax with a distinct fore-lobe; the wings are sub-ferruginous. It is an inhabitant of Africa.

CILIATA. Testaceous; abdomen blue; mandibles elongated and ciliate. This is an Indian insect.

COMPRESSA. Shining green; the hind-thighs are compressed, ferruginous. It inhabits Malabar.

SIBIRICA. Polished brassy-green; the abdomen is blue. An inhabitant of Siberia.

ICHNEUMONEA. Fulvous; abdomen black, with a ferruginous base. It is found in divers parts of America.

HIRTIPES. Hairy, dusky; abdomen shining black; wings testaceous. It inhabits Guinea.

ALBIFRONS. Glabrous, black; front covered with a silvery brown; wings white, with a black base. This also is found in Guinea.

MAXILLOSA. Black, with silvery down; abdomen ferruginous at the base; the mandibles are projected, curved, and toothed. It is a large insect, and is found in Barbary.

UNICOLOR. Dusky-brown, with cinereous down. It is found in Spain, on umbellate flowers.

INDOSTANEE. Black; wings blueish-black, with a hyaline thinner margin. Found in Europe and India.

CLAVIPES. Black; petiole ferruginous, clavate, of one joint; legs clavate. This is a small insect, and is found in several parts of Europe.

AUSTRIACA. Black; base of the abdomen with a sulphur-coloured band and two dots; the legs are varied with sulphur; the hind-thighs are thickened. It inhabits, as its name denotes, Austria.

BIDENS. Black; head and antennæ ferruginous; the abdomen is marked with four yellow spots; the thorax is two-spined. It inhabits Mauritania, and is a large insect.

INSUBRICA. Black; front, mouth, scutell, and two bands on the abdomen, of a pale yellow. It inhabits Padua; breeds in chimneys and windows, in the same nest with the Ichneumon seductor.

b. *Abdomen sessile.*

MORIO. Black, immaculate; wings dark brown. It inhabits New Holland.

COLLARIS. Black-blue; fore-lobe of the thorax fulvous. It inhabits New Holland.

FRONTALIS. Black; front and fore-lobe of the thorax yellow. It inhabits New Holland.

ANALIS. Glabrous, black; abdomen ferruginous at the tip; wings white. It inhabits India.

SIMILIS. This insect is glabrous, black, abdomen ferruginous at the tip; the wings are white.

ASSIMILIS. Black; antennæ, tail, and legs, rufous; wings blue; the base and tip white. This is found at Tranquebar.

DIMIDIATA. Black; the head and fore-part of the thorax dull ferruginous; the wings are black. This is an inhabitant of Barbary.

* **FUSCA.** Black, glabrous; base of the abdomen ferruginous. This inhabits gravelly places in Europe; after having destroyed the larva of a moth, it deposits its eggs in its carcase, and then digs a hole and buries it.

VIATICA. Black, downy; fore-part of the abdomen ferruginous, with black belts; wings brown.

URSUS. Black, hairy; second segment of the abdomen ferruginous; wings black.

AMETHYSTINA. Blue; antennæ and legs black. It inhabits Santa Cruz.

CINGULATA. Black; front streak on the fore-part of the thorax, and edges of the abdominal segments, cinereous. It inhabits New Holland.

NIGRA. Black; segments of the abdomen with lucid margins.

LABIATA. Black; segments of the abdomen edged with cinereous; the wings are testaceous, tipped with brown. It inhabits the South American islands.

VARIEGATA. Black, spotted with white; thorax rufous under the scutell; the wings are tipped with brown. This is found in Saxony.

SANGUIOLENTA. Black; thorax rufous before and behind; segments of the abdomen lucid at the margin. This is a very small insect, and is found in several parts of Germany.

MIXTA. Black, varied with yellow; abdomen yellow, with three black bands. This is an American insect.

MAURA. Black; hind-thighs rufous; inhabits Tranquebar.

HYALINATA. Black; four hind-thighs rufous; wings hyaline. Found in Saxony.

FUSCATA. Black; abdomen with a white transverse dot

SPHEX.

on each side; hind-thighs rufous; wings tipped with brown. It inhabits Saxony.

SEX-PUNCTATA. Black, with two white dots under the scutellum, and four on the abdomen; wings tipped with brown.

BI-FASCIATA. Black, immaculate; wings with two black bands. This is an inhabitant of Paris.

GIBBA. Black; abdomen ferruginous, tipped with brown; upper wings brown at the tip. This is found in divers parts of Europe.

FASCIATA. Black; antennæ rufous; wings white, with two brown bands. This is found in New Holland, as is the next.

CINEREA. Cinereous; segments of the abdomen black at the base, and brown at the tip.

TROPICA. Black; second segment of the abdomen ferruginous. This is found in different parts of America.

FUGAX. Thorax covered with gold down; abdomen ferruginous; wings yellowish, with a brown band.

AURATA. Head and thorax with gold down; abdomen black, the edges of the segments cinereous. This is found in the East Indies.

NITIDA. Ferruginous; thorax golden behind; wings yellowish. It inhabits New Holland.

* **RUFIPES.** Black; the segments of the abdomen are marked with a white dot on each side; the wings are tipped with brown. Found in England, and on divers parts of the European continent.

BI-PUNCTATA. Black, glabrous; abdomen marked with two white dots and a band behind; the wings are tipped with brown. This is an European insect.

NIGRICORNIS. Black; head and thorax rufous. It is found in New Holland.

EXALTATA. Black; abdomen rufous, tipped with black; wings brown at the tip, with a white dot.

MACULATA. Black; thorax spotted with white; first segment of the abdomen rufous, the rest with a transverse white line on each side. It inhabits Kiel.

TRICOLORATA. Black; abdomen with silver lunules on each side, the base is rufous, the tip black. This is a Barbary insect.

GUTTATA. Black, glabrous; thorax spotted with white; abdomen rufous, with transverse dots, and black before the tip. This is very like the *S. maculata*, and is found in Italy.

ABDOMINALIS. Black; thorax with a cinereous band before; abdomen rufous; wings tipped with brown. It inhabits Brazil.

CAPENSIS. Black; antennæ, shanks, and wings testaceous, the latter tipped with brown. It inhabits the Cape of Good Hope.

NIGRITA. Black; wings blue. Inhabits Malabar.

TURCICA. Black; thorax with a cinereous band before; abdomen rufous; wings black. It is an inhabitant of Brazil.

NIGRIPES. Black; abdomen ferruginous; wings dusky; legs black. It inhabits Africa.

VILLOSA. Black; abdomen villous, testaceous; wings deep black; legs rufous. It is found at Malabar, and is very small.

DISCOLOR. Black, glabrous; wings yellow, tipped with black. It is found in Barbary.

FLAVA. Black; head, thorax, and tail, ferruginous; wings yellow, tipped with brown. It is found in the East Indies.

BICOLORATA. Black; head, tip of the abdomen, and wings, yellow, the latter tipped with brown. This is a New Holland insect.

SPECIOSA. Deep black; wings rufous, tipped with white.

FULVIPENNIS. Black; head, fore-part of the thorax, tail and legs, rufous; wings fulvous, tipped with blue. This is an inhabitant of India.

NOBILIS. This species is varied with silver and black; wings white, with two black bands. It inhabits Cayenne.

BREVICORNIS. Black; thorax ferruginous; abdomen with six white spots. It is found in Barbary: in a variety the abdomen is immaculate.

OCCELLATA. Black; legs testaceous; wings black, with an ocellar ferruginous spot on the upper pair. Found in Africa.

RUFICORNIS. Blue; antennæ rufous; legs black.

QUADRI-PUNCTATA. Black; antennæ, streaks on the fore-part of the thorax and scutellum; there are four dots on the abdomen, and the wings are ferruginous. It is found in Spain.

CÆRULEA. Blue; wings ferruginous, upper pair whitish at the tip. It inhabits South America, as does the next.

STELLATA. Blue; wings black, upper pair with a rufous spot in the middle, and whitish at the tip.

PLUMBEA. Lead-colour; antennæ black; upper wings tipped with brown. It is found in Spain, and is very small.

PECTINIPES. Black, glabrous; fore-part of the abdomen ferruginous; fore-legs ciliate.

VARIEGATA. Entirely black; wings spotted with white. Seen in divers parts of Europe.

ANTARCTICA. Black; antennæ and legs ferruginous; is about the size of a wasp, and is found at the Cape of Good Hope.

PALMIPES. Black; thorax with two yellow dots at the tip, and one at the base; the fore-legs are palmate. It inhabits Sweden.

EPHIPPICA. Black; front blueish; abdomen with a double ferruginous band. It is the size of a gnat, and inhabits Sweden.

STIGMA. Wings angular, grey-brown and reddish beneath, with white spots. It is an inhabitant of the Cape.

INDICA. Black; antennæ and legs ferruginous; wings blueish-black. It is found in South America.

COLON. Black; antennæ and legs rufous; thorax green; wings with two black spots. It inhabits Sweden.

MAURITANICA. Black; head, antennæ, and legs, ferruginous, with a black border. It inhabits Mauritania, and is reckoned among the large insects of this genus.

COLLARIS. Black; wings brown, with a white band in the middle and at the end; antennæ and legs testaceous. Inhabits Spain, and is the size of a common ant. Its neck is yellow.

CORONATA. Abdomen black, with two yellow belts and dots; head and thorax spotted with yellow. It inhabits Switzerland.

* **XANTHOCEPHALUS.** Black; front yellow; abdomen and legs spotted with yellow. It inhabits England.

* **SPINOSA.** Black; thorax with a spine on each side behind; the lip and breast are silvery. It inhabits England.

ALBOMACULATA. Black; abdomen ferruginous at the base; wings brown, with a white spot at the tip.

TRICOLOR. Black; segments of the abdomen very varied in number, some of them are testaceous, and others dotted with white.

BOOPS. Black; three segments of the abdomen and tarsi testaceous. It is an Austrian insect.

TOMENTOSA. Black, downy; antennæ thick at the base;

base; the three first segments of the abdomen are ferruginous; the base and tip are black.

COCCINEA. Black; antennæ, jaws, tip of the abdomen, and flanks, scarlet; thorax with a tooth on each side behind; wings yellow, the hind margin brown.

SPINIPES. Black, hairy; wings yellow; the hind margin brown, with a black spot at the base of the upper pair; segments of the abdomen vary from two to four, which are yellow on the hind margin of each side. Its abode is not known.

GUTTATA. Black; with white lines and dots; wings pale yellow; legs rufous.

LEUCOMELLIS. Black; wings white towards the hind margin; first segment of the abdomen white on each side; the third with an ovate white spot on the back; the four hind-legs are rufous.

MELANOCHLORA. Black; abdomen ferruginous at the base. This is an European insect.

TESTACEA. Black; legs and abdomen testaceous, the latter brown at the tip.

CASPA. The abdomen of this is black, with four yellow elevated bands; the three upper ones intersected by a triangular black spot. It inhabits near the Caspian sea.

SPHINCTER, in *Anatomy*, a name given to muscles which surround, and have the office of closing, certain openings.

SPHINCTER Ani, the muscle surrounding the extremity of the large intestine. See **INTESTINE**.

SPHINCTER Laborum, the same as the orbicularis oris. See **DEGLUTITION**.

SPHINCTER Iridis. See **EYE**.

SPHINCTER Oesophagi. See **DEGLUTITION**.

SPHINCTER Vagine. See the description of that canal under **GENERATION**.

SPHINCTER Vesicae. See the description of the urinary bladder under **KIDNEY**.

SPHINX, σφιγξ, in *Sculpture*, &c. a figure or representation of a monster of that name, famed among the ancients, now mostly used as an ornament in gardens, terraces, &c.

It is represented with the head and breasts of a woman, the wings of a bird, the claws of a lion, and the rest of the body like a dog or lion.

It is supposed to have been engendered by Typhon, and sent by Juno to be revenged on the Thebans. Its office, they say, was to propose dark enigmatical questions to all passers by; and, if they did not give the explication of them, to devour them.

It made horrible ravages, as the story goes, on a mountain near Thebes, and could not by any means be destroyed, till after Ædipus had solved the following riddle: What animal is it that in the morning walks on four legs, at noon on two, and at night on three? The answer was, Man.

Among the Egyptians, the sphinx was the symbol of religion, by reason of the obscurity of its mysteries. And, on the same account, the Romans placed a sphinx in the pronaos or porch of their temples.

Sphinxes were used by the Egyptians to shew the beginning of the water's rising in the Nile: with this view, as it had the head of a woman and body of a lion, it signified that the Nile began to swell in the months of July and August, when the sun passes through the signs of Leo and Virgo. Accordingly it was a hieroglyphic, which taught the people the period of the most important event in the year, as the swelling and overflowing of the Nile gave fertility to Egypt. Accordingly they were multiplied without end, so that they were to be seen before all their temples, and before all their remarkable monuments,

There are several of these still to be seen; one in particular, near the pyramids, facing the second pyramid on the eastern side, much spoken of by the ancients, being of a prodigious size, and cut out of the rock; the head and neck only appear at present, the rest of the body being hid in the sand. The top of its back only is visible, which is more than 100 feet long. It is of one single stone, making part of the rock on which the pyramids are placed. Its head rises about twenty-nine feet above the sand. This, according to Thevenot, is twenty-six feet high, and fifteen feet from the ear to the chin; but Pliny assures us, the head was no less than one hundred and two feet in circumference, and sixty-two feet high from the belly, and that the body was one hundred and forty-three feet long, and was thought to be the sepulchre of king Amasis.

Some have suggested, that the well of the great pyramid led to this monster, and that the priests resorted thither at certain times to pronounce their oracles; alleging, that a hole placed at the top of the sphinx's head answered their purpose; but this hole is only five feet deep, and communicates neither with the mouth nor with the inside of the monster. The Arabs, inspired by Mahomet with a horror for all representations of men and animals, have disfigured its face with arrows and lances. Some have urged, without sufficient reason, that the sphinx countenances the opinion that the Egyptians were black, the face of that statue having been said to resemble the negro. The statues of the Nile, it is said, were made of black marble, in allusion to his coming from Ethiopia. If the sphinx was a symbol that had any relation to this subject, might not the negro face be given to it for a similar reason? It would hardly have been thought necessary to explain why the figure of the Nile was black, if the complexion of the natives had been generally acknowledged of the same tinge.

The small statues of Isis, &c. frequently found among the ruins of Egypt, are far from resembling those of the negro: the same observation is applicable to the figures in alto relievo and basso relievo, on the walls of Thebes, in the caverns of Gebel-el-Sillili, &c. Of the colossal statues at Thebes, the features are too much damaged to be adduced in proof of the pretended fact.

The learned Mr. Bryant (*Anc. Mythol.* vol. iii. p. 532.) observes, that the sphinx seems to have been originally a vast rock of different strata; which, from a shapeless mass, the Egyptians fashioned into an object of beauty and veneration.

The Egyptians used this figure in their building; from them the Greeks derived it, and afterwards improved it into an elegant ornament.

SPHINX, the *Hawk-moth*, in *Entomology*, a genus of insects of the order Lepidoptera, of which the generic character is as follows: Antennæ somewhat prismatic, tapering at each end; the tongue is exerted; feelers two, reflected; the wings are deflected.

The insects of this genus, of which there are nearly two hundred species, fly abroad only in the morning and evening; they are very slow on the wing, and often make a humming kind of noise: they extract the nectar of flowers with the tongue. The generic name, sphinx, is applied on account of the posture assumed by the larvæ of several of the larger species, which are often seen in an attitude much resembling that of the Egyptian sphinx, viz. with the fore-parts elevated, and the rest of the body applied flat to the surface.

The larva has sixteen feet, and is pretty active; that of the *Zygana*, a division of this genus, is thick and flat, and covered with short hairs; that of the *Sesia* is generally naked, unarmed, and thinner towards the head; the others have a sharp,

sharp, erect, stiff horn behind; the pupa is quiescent: that of the *zygæna* folliculate, and a little tapering forwards, the rest naked and smooth; that of the *sesia* pointed at each end, of the others very obtuse behind.

There are three divisions of this genus; *viz.* A, of which the antennæ are scaly; feelers hairy; tongue spiral; B, in which the antennæ are cylindrical; the tongue is exerted, truncate, and the wings entire; and C, in which the antennæ are thicker in the middle; tongue exerted, setaceous. Of the principal species of these divisions we shall proceed to give a brief account.

Species.

A. *Antennæ scaly; Feelers hairy; Tongue spiral.*

* *OCELLATA.* Wings angular, lower ones rufous, with a blue eye. This is reckoned a very beautiful insect; its upper wings and body are brown, the former finely clouded with different shades, while the lower wings are of a bright rose-colour, each marked with a large ocellated black spot, with a blue interior circle and a black centre. This insect proceeds from a green caterpillar of a rough or shagreen-like surface, marked on each side by seven oblique yellowish-white streaks, and furnished, like the preceding, with a horn at the tail. It is chiefly found on the willow; retires under ground, in order to undergo its change into the chrysalis state, in the month of August or September, and in the following June appears the complete insect.

MYOPS. Wings angular; upper pair with a yellow spot at the tip and posterior angle; lower ones yellow, with a blue eye.

QUERCUS. Wings angular, indented, cinereous, with dark streaks; lower ones ferruginous, white at the angle of the tail. This inhabits Germany. The larva is solitary and of a green colour, with oblique lateral stripes and rufous stigmata; pupa chestnut, with rufous margin.

LUSCA. Wings angular, dusky, with a black dot; lower ones black, with a fulvous band. It inhabits the South American islands. The upper wings are cinereous, with brown flexuous bands; lower wings cinereous at the angle of the tail, with a fulvous blotch; beneath it is a dull grey, and immaculate.

* *POPULI.* Wings indented, reversed, grey; upper pair with a white central spot; lower ones ferruginous at the base. This is found in England and many parts of Europe. It is figured by Donovan, and other writers on natural history. The larva is solitary, rough, green, with oblique white stripes on the sides; the pupa is of a dull brown, but ferruginous behind.

* *TILLE.* Wings angular, with greenish clouds and darker bands; lower ones beneath yellow, testaceous. The larva is solitary, rough, green, with oblique red and yellow stripes on the sides; the pupa is brown.

PYLAS. Wings scalloped, indented, variegated; lower ones fulvous, yellow at the base, and black at the tip. It inhabits Surinam. Lower wings with a marginal black band, and contiguous smaller one; the edge itself is yellowish.

CACUS. Wings indented, black, with three approximate pale streaks; lower ones are yellow, striate with black. The abdomen is marked with cinereous and black belts.

DENTATA. Wings indented; lower ones brown, with a white streak; the abdomen is annulate with white. It is an Indian insect. The head and thorax are blueish, speckled with brown; the upper wings are blueish, with brown specks and bands.

ALOPE. Wings indented, brown; lower ones yellow, tipped with black; abdomen black, with interrupted pale belts.

This is found in divers parts of America. The larva of this species is tailed and glabrous, cinereous on the back, with a broad brown streak before; ocellate in the middle, and ending in a black spot; pupa brown, with rufous rings and streaks.

JATROPHÆ. Wings slightly indented; lower one black, with a rufous base and hyaline band; the head is two-horned. The larva is green, with a moniliform tail; the pupa is brown, with an inflected cylindrical tail.

* *ATROPOS.* The wings of the insects of this species are entire; the lower ones are yellow, with two brown bands; the abdomen is yellow, with belts. This is said to be the largest and most remarkable, if not the most beautiful, European insect of this genus. It is thus described by Dr. Shaw: the upper wings are of a fine dark grey colour, with a few slight variations of dull orange and white; the under wings are of a bright orange colour, marked by a pair of transverse black bands; the body is also orange-coloured, with the sides marked by black bars, while along the top of the back, from the thorax to the tail, runs a broad blue-grey stripe; on the top of the thorax is a very large patch of a most singular appearance, exactly representing the usual figure of a skull, or death's head, and is of a pale grey, varied with dull ochre and black. When in the least disturbed or irritated, this insect emits a stridulous sound, something like the squeaking of a mouse; and from this circumstance, as well as from the mark above-mentioned on the thorax, it is held in much dread by the vulgar in several parts of Europe, its appearance being regarded as a kind of ill omen or harbinger of approaching fate. Reaumur mentions, that the members of a female convent in France were thrown into great consternation at the appearance of one of these insects, which happened to fly in during the evening at one of the windows of the dormitory. The caterpillar from which this curious sphinx proceeds, is in the highest degree beautiful, and far surpasses in size every other European insect of the kind, measuring sometimes nearly five inches in length, and being of a proportional thickness; its colour is a bright yellow; the sides are marked with a row of seven most elegant broad stripes or bands, of a mixed violet and sky-blue colour; the tops of these bands meet on the back in so many angles, and are varied on that part with jet black specks; on the last joint of the body is a horn or process, not in an erect position, but hanging or curving over the joint in the manner of a tail, having a rough surface and a yellow colour. This caterpillar is principally found on the potatoe and the jessamine, which are its favourite food. It changes into a chrysalis in the month of September, retiring for that purpose deep in the earth; the perfect insect emerging in the following June or July. Individuals have been observed to change into the chrysalis in July or August, and then produce the complete insect in November, so that there appear to be two broods or races in a year.

The *S. atropos* is generally considered as a rare insect, and as the caterpillar feeds chiefly by night, concealing itself during the day under leaves, &c. it is not often detected; yet from some singular circumstances favourable to its breed, there are seasons in which it is even plentiful, as was the case in the autumn of 1804, in which the caterpillar was so common in some counties, as to be prejudicial to the potatoe-plants, particularly in some parts of Cornwall and Surry.

“The alteration of form which the whole of the papilionaceous tribe undergo, and in a particular manner the changes of the sphinx genus, afford a subject of the most pleasing contemplation to the mind of the naturalist, and though a deeply philosophical survey demonstrates that there is no

real change produced in the identity of the creature itself, or that it is in reality no other than the gradual and progressive evolution of parts before concealed, and which lay masked under the form of an insect of a widely different appearance, yet it is justly viewed with the highest admiration, and even generally acknowledged as in the most lively manner typical of the last eventful changes."

CHIONANTHI. Wings variegated, with a white dot in the middle; abdomen with three pair of fulvous eyes. This is an American insect. The antennæ are hooked, ferruginous, with a white shaft; lower wings blackish, spotted with white. Larva tailed, with yellow and black bands; the head and tail are red; the pupa is brown.

* **PINASTRI.** Wings entire, grey, with three short black lines in the middle of the upper pair; the abdomen is white, with black bands. The larva is tailed, and greenish, with a ferruginous dorsal line, a lateral yellow one, and ferruginous subocellar stigmata: the pupa is reddish-brown, with white eyes.

* **EUPHORBÆ.** Wings entire, with two dark olive bands; lower ones with a black base, and marginal streak; the antennæ are snowy. It is found in this country, and divers parts of Europe. Donovan has given a figure of it. The larva is black, dotted with white; it has a red line down the back, and lateral yellow spots; the pupa is brown, with black stigmata.

* **LINEATA.** Wings greenish-olive, with a white band, crossed with white streaks; the lower ones are black, with a red band. It is generally described as having a greenish head, with a lateral white line; the thorax is marked with three double white streaks; abdomen with a white line down the middle, and lateral black and white dots; the hind margin of the upper wings is of a purple colour. Beneath it is cinereous, speckled with green.

* **CELARIO.** Wings entire, grey, with silvery-white streaks; the lower ones are brown, with six red spots. The larva is tailed, brown, with two lateral pale lines, and two eyes on the neck, on each side; the pupa is brown before and reddish behind.

* **ELPENOR.** Wings entire, with transverse greenish-brown and red bands; the lower ones are red, with a black base. The larva is tailed, with brown spots and two blue eyes on each side of the neck; the pupa is grey before, behind brown, with darker stigmata.

* **PORCELLUS.** Wings entire, varied with yellow and purple; the abdomen is beneath sanguineous, dotted with white. The larva is without a tail, brown, with three blue eyes on each side of the neck; the pupa is blackish.

* **CONVOLVULI.** Wings entire, clouded; lower ones slightly barred; abdomen with red, black, and white belts. This is found in our own country, and other parts of Europe. The larva is tailed, with oblique white lines on the sides; the pupa is brown, with a reflected involute horn. The eyes of this insect are said to be slightly phosphorescent.

* **LIGUSTRI,** or Privet Hawk-moth. Wings entire; lower ones rufous, with three black bands; the abdomen is red, with black belts. The larva is tailed; in colour it is green, with oblique lateral streaks, which are of a flesh-colour before, and white behind; the pupa is brown; the tail is four-toothed.

CRANTOR. Wings entire, brown, spotted with black; lower ones red, edged with black. It inhabits India. The upper wings are marked with a pale spot at the base; the lower wings are spotted with black at the angle of the tail.

LABRUSCÆ. Wings greenish, with a white dot on the

lower surface of the upper pair; the abdomen is marked with five white dots at the sides. This is an American insect. The lower wings are marked with a black disk, barred with a blue rufous spot at the angle of the tail. The larva is tailed, varied with brown and black; on the tail is a white polished moveable dot.

B. *Antennæ cylindrical; tongue exerted, truncate; wings entire. This division is named*

SESIA.

TANTALUS. Abdomen bearded, the third segment snowy. It inhabits Europe and India. The abdomen is marked with a white and rufous streak; upper wings variegated with three white dots.

HYLAS. Wings semi-transparent; abdomen bearded, green, with a purple belt. It inhabits China. The tail is marked with a white dot at the base; the sides of the base are black.

* **STELLATARUM.** Abdomen bearded, the sides are varied with black and white; the lower wings are ferruginous. The larva is pale rosy, dotted with white; the tail blue, ferruginous at the tip; the pupa is pale, with a brown tip.

PANDORA. Abdomen bearded, with fulvous spots on the sides; the lower wings are ferruginous at the base, and tip with black.

FUCIFORMIS. Abdomen bearded, blackish, with a yellow band near the tail; wings diaphanous, with a darker brown border; beard of the abdomen black on each side. The larva is green, with a yellow lateral line; the horn is erect; pupa folliculate, black, with yellow streaks before.

* **BOMBYLIFORMIS.** Abdomen bearded, greenish, fulvous, with a black band; the wings are transparent, with a fine black edge.

* **APIFORMIS.** This species is of an aspect at first sight more resembling that of a wasp, or hornet, than of a sphinx, the wings being transparent, with merely a slight edging of brown, and the thorax and abdomen varied with black and yellow. The caterpillar inhabits the hollows of poplar, fallow, willow, and lime-trees, feeding on the substance of the bark; changing to a chrysalis in April, and the fly appearing in the month of June.

* **CRABRONIFORMIS.** Wings transparent; abdomen yellow, with black belts; thorax black, with obsolete yellow spots; the head is black, with a yellow ring at the base. The larva is yellow; the pupa is reddish-brown. The male has two black bands near the base of the abdomen; the female is marked with irregular black lines.

* **CULICIFORMIS.** Wings hyaline, with a black band and margin; the abdomen is bearded, with a fulvous belt; the antennæ are white before the tip.

* **TIPULIFORMIS.** Wings transparent, with a black band and margin; the abdomen is bearded, black; the alternate incisions are edged with yellow. This is figured by Donovan. The thorax has a yellow line on each side; tip of the upper wings marked with a brown spot. The larva is solitary, a little hairy, whitish, with yellow head and legs, and a darker dorsal line; the pupa is brown.

* **ZONATA.** Wings transparent, with a black band and margin; the abdomen is bearded, black, with a single belt. It is found in divers parts of Europe, as well as in this country. The head is marked with a thin red margin, on the thorax are two oblique lateral red lines.

ICHNEUMONIFORMIS. Wings transparent, with a black margin and band, in which is a fulvous dot; the abdomen is

marked

marked with alternate black and white belts. It inhabits Auftria.

* **VESPIFORMIS.** Wings transparent, with a black margin and band; abdomen bearded, black, the second and last segments edged with yellow. It is found in this country, and many parts of Europe.

* **CHRYSORRILÆA.** Wings transparent, with a black margin and band; abdomen black, with four yellow belts; the beard is yellow, with a black line in the middle. This is an English insect, and is figured by Donovan.

C. *Antenna thicker in the middle; tongue exerted, setaceous.*

ZYGÆNA.

* **FILIPENDULÆ.** Upper wings blue-green, with six red spots in pairs; the lower ones are red, with a greenish border. It is found in England, and other parts of Europe. The larva is flat, tailed, sulphur-coloured, with four lines of black dots; the pupa is brown, but in the middle it is of a sulphur-colour.

SEDI. Blue; upper wings with three connected red spots; the lower ones are entirely red. It inhabits southern Russia. The spots on the wings are furrounded with a yellow ring, and the lower wings with a fine black edge.

PHEGEA. Green-black; the upper wings are marked with six transparent dots, the lower ones with two; the abdomen with a yellow belt. It is found in many parts of Germany. The larva is brown; the head and legs are reddish; the back is marked with fasciculate white plumes.

CAFFRA. Black; wings brown, with five red dots; the lower ones are red, edged with brown. It is found in many parts of Africa. The head is black; feelers and orbits red; thorax black, with two red dots on each side; dots on the wings furrounded with a black ring.

CASSANDRA. Brown; abdomen with five blue spots on each side; tail, mouth, base of the thighs, and abdomen, scarlet.

ANDROMACHA. Black; wings hyaline, with a black margin and band; the tail is red. It inhabits America.

LETHÆ. Wings black, with two yellow spots; abdomen with red, black, and blue belts, and a white one. This is an African insect.

PECTICORNIS. Brownish; wings violet, with two white bands a little interrupted; the collar is red. It is found in South America.

SYPIUS. Wings black; upper pair with an interrupted testaceous band; lower ones testaceous at the base; the abdomen is dotted with blue. It inhabits different parts of America. The abdomen is black, with testaceous belts at the base; the tip is dotted with blue.

CAPISTRATA. Wings black, with two transparent bands on the upper pair; the lower ones have a transparent disk; the abdomen is red and black on the back. It inhabits America.

COLUMBINA. Wings transparent, with a black spot, and border marked with red. It inhabits South America. The antennæ are pectinate; the head is black, with two red dots; the thorax is marked with white lines; the abdomen is black, the first segment is red, the others are marked with white and red belts.

CAUDATA. Wings yellow, hyaline, tipped with brown; body spotted with gold. This inhabits South America.

DIPTERA. Wings brown; upper pair with five transparent spots; lower ones very short, with a yellow spot. This inhabits the East Indies.

TIBIALIS. Upper wings brown, lower ones hyaline; hind-legs long and very hairy. It inhabits Africa.

CAPYS. Black; upper wings tipped with white. Inhabits Surinam.

* **STATICES.** Upper wings green-blue; lower ones brown. Inhabits divers parts of Europe, as well as this country.

ACIARON. Blue; wings brown; tail rufous. It inhabits New Holland.

STYX. Body and wings blue; thorax rufous. It is found in Africa.

THOAS. Upper wings brown; lower ones black, with semitransparent disk; collar red.

SPHINX, a name given by Reaumur to a very singular species of caterpillar, described in the second volume of his History of Insects.

The reason of the author's having given it that name is, that when it is not eating it erects its head, and with it more than a third part of its body, into a perpendicular situation upon the leaf on which it was before laid all along; it keeps itself a long time in this situation, looking around it with a seeming air of fierceness. There is also a series of broad belts upon the body, which contribute something towards its resemblance to the figure of that imaginary monster.

This caterpillar has a horn on the hinder part of its body, which seems to be of no sort of use, but merely a trouble to the creature. It is hollow, and incloses, in the manner of a sheath, the new horn which is to appear when the creature changes its skin. This the author found to be the case, by cutting it several times, and always finding within it the new horn cut off also at the same place, and had often observed the great difficulty the animal had in changing its skin, when it came to the horn.

SPHINX, Simia. See SIMIA.

SPHONDYLIIUM, in *Botany*, σφονδύλιον of Dioscorides, the Cow-parfnip. See HERACLEUM.

SPHONDYLOCOCCLUS, so called, by Mitchell, from the whorled appearance of the berries, is the Linnæan CAL-LICARPA. See that article.

SPHONDYLUS, in *Ichthyology*, a name given by Pliny, and others of the old authors, to a peculiar species of the syngnathus, or *acus Aristotelis*. It is the species, called by Artedi *syngnathus corpore medio hexagono cauda pinnata*; and by other authors the *acus secunde species*; and by Bellonius and Gefner *typhle marina*.

SPHONDYLUS is also used by some authors, for the stones or bones found in the head of a mullet.

SPHRAGIDE, or *Lemnian Earth*, in *Mineralogy*, a name given by Werner to a substance nearly resembling fullers'-earth, found in the island of Lemnos, in the Mediterranean. It is of a greyish or yellowish-white colour; it has a dull aspect and a meagre feel, in which respect it differs from fullers'-earth; it adheres slightly to the tongue, and falls to pieces when immersed in water. The constituent parts of this mineral, as given by Klaproth, are,

Silex	-	-	-	-	66
Alumine	-	-	-	-	14.50
Magnesia	-	-	-	-	0.25
Lime	-	-	-	-	0.25
Soda	-	-	-	-	3.50
Oxyd of iron	-	-	-	-	6
Water	-	-	-	-	8

This earth is dug but once a year, on the 15th of August, in the presence of the clergy and magistrates of the island, after the reading of prayers. The clay is cut into long pieces of an ounce weight, and each of them is afterwards stamped with a seal, having on it the Turkish name of the mineral. It is in great repute in the East, as an anti-

dote against poison and the plague; and even in the time of Homer was valued on the same account. It was then stamped as at present, and none but priests were allowed to handle it. Severe punishments were also inflicted on those who presumed to dig for it at any other but the stated period. The geological position of this mineral is unknown. See FULLERS'-*Earth*, and LEMNIAN *Earth*.

SPHRAGIS, the seal-stone, a name given by some authors to the single joints of the asterix, when found loose, not joined into a column. See STAR-*Stone*.

SPHRAGIS is also used by some of the old Greek naturalists, to express the spots on the back and sides of a panther.

The skin of this creature is of a pale colour, and these spots are all dark and round, and look like so many regular impressions of a seal, whence the name sphragis.

The Romans called any thing that was variegated in this manner *pantherina*; and we meet with the phrase *mensa pantherina*, used to express tables found of some wood, which was variegated with round spots, in the manner of those sphrages on the back of the panther.

SPHYGMICA, in *Medicine*, a term used by some for that part of the judgment of a physician, which regards the differences of the σφυγμοί, or *pulse*.

SPHYRÆNA, in *Ichthyology*, a name by which some authors have called the *Judis*, or *Lucius marinus*, the sea-pike.

SPHYRÆNA *Altera*, a name given by Appian, and some other of the old Greek writers, to the *fox*, or common pike.

SPICA, in *Botany* and *Vegetable Physiology*, a spike, is a mode of inflorescence, very general in the natural order of *Orchidea*, and frequent among many other tribes of plants. It is composed of several flowers, ranged along a common flower-stalk, without any partial ones, each individual flower being sessile. The spike is generally erect at the time the flowers expand, and the latter are less crowded than in a RACEMUS. See that article, and INFLORESCENCE.

SPICA *Bandage*, in *Surgery*, is a kind of bandage thus called from its interfections, which are supposed to resemble an ear of corn. It is either simple or double. The simple spica, applied to the clavicle, when fractured near the shoulder, consists of a simple band, about five ells long, and three fingers breadth, rolled up either with one or with two heads. The double spica, which is used when the ossa humeri of each arm are dislocated, is a band about seven or eight ells long, and three or four fingers breadth, rolled up with two heads: the middle is fixed under the axilla, and the two heads cross each other upon the shoulder, and go over the breast and back to the opposite axilla; here they cross again, and then rise up over the other shoulder as before, from whence they go across the breast, and back again to the left axilla, where they began, forming an X, by traversing each other upon the sternum and back. See BANDAGE.

SPICA *Virginis*, a star of the first magnitude in the constellation Virgo.

SPICCATO, Ital., distinct, detached, separated, in *Musæ*, as if half the note were cut off by a rest. This term is nearly of the same signification as *sciolto* and *staccato*; except that, on the violin, when spiccato is written over or under a group of notes, they are to be touched lightly with the vibration of one bow; and sciolto and staccato passages and movements require a strong bow to every note.

SPICE, any kind of aromatic drug, that has hot and pungent qualities: such are pepper, nutmeg, ginger, cinnamon, and cloves. Some also apply the word to divers

other medicinal drugs brought from the East; as fenna, cassia, frankincense, &c. See each under its proper article.

SPICE, *All.* See PIMENTO.

SPICE-Wood, in *Botany*, a species of *Laurus*; which see.

SPICES, *Garbler of.* See GARBLER.

SPICHEROEG, in *Geography*, a small island in the German sea, near the coast of Friesland. S. lat. 53° 43'. E. long. 7° 32'.

SPICULUM, in *Roman Antiquity*, a kind of weapon which some will have to be the same with the hasta, or spear.

SPIDER, in *Entomology*, is the trivial name by which the large genus ARANEA is generally known: under that term we promised to give an account of the species in their alphabetical order; this, from a change in the plan, having been neglected, we shall take the opportunity which the word *spider* affords, of enumerating those species in as brief a manner as the subject will allow. We shall, however, be under the necessity of giving in this place the generic character, which is as follows: Mouth with short horny jaws, the lip rounded at the tip; two feelers, incurved, jointed and very sharp at the end; those of the male are clavate; they have no antennæ, generally eight eyes, but sometimes only six. Eight legs; the abdomen is ovate, villous, furnished at the tip with textorial papillæ.

Much interesting matter on the subject of spiders will be found in the article ARANEA; here it may be observed, that in every stage of their existence, these animals prey with the utmost ferocity upon all other insects that they can overcome, and even upon one another: from the papillæ at the end of the abdomen, they throw out at pleasure a number of fine threads, which they unite in various ways, for the purpose of entangling their prey. They every year cast off their old skin, which is performed by suspending themselves in some solitary corner, and creeping out of it. The younger ones have the power of flight, and in the autumn mount in the air to a great height; to perform which, they probably ascend some lofty eminence, and are wafted about by the winds, filling the atmosphere with their fine threads. The spider is infested by the *sphæx* and *ichneumon*; which see respectively.

Gmelin has enumerated more than a hundred and twenty species of this genus, which are separated into distinct sections, according to the number and position of their eyes.

Species.

A. Eyes placed

* EXTENSA. Abdomen long, silvery-greenish; legs longitudinally extended. This species is found chiefly in the woods of this country, and other parts of Europe. The head, thorax, and legs, are reddish; the abdomen is greenish down the back; the first pair of legs very long; the third very short.

PALLENS. Pale testaceous; mandibles ferruginous, with black claws. It inhabits the American islands.

LOBATA. Abdomen ovate, lobed, white, with double brown lines at the tip. It inhabits the Cape of Good Hope.

LONGIMANA. Ferruginous; abdomen long, cylindrical, brown. It inhabits Jamaica. The fore-legs very long, hence its specific name; third pair very short.

REGIA. Villous, cinereous, with a yellow band on the front; the legs are spinous. It inhabits Tranquebar, and is large.

VIRESCENS. Green, with a black cylindrical abdomen; the fore-legs very long. It inhabits Zealand.

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CANCRIFORMIS. Abdomen globular, gibbous, with six spines round the margin. This is found in Jamaica.

VENATORIA. Glossy-black, with a blackish hairy abdomen. This is an American insect, which spins a large cylindrical web under ground, which is covered with a lid; its bite is very painful, and frequently occasions fever, and even delirium, which are however quickly removed by sudorifics.

13-GUTTATA. Black; abdomen rounded, and spotted with red. This is an Italian insect. Its bite is said to be very pernicious; it preys on crickets, which it encompasses and entangles in a web.

* **LATENS.** Black; abdomen greyish, with a black interrupted dorsal line. It inhabits England, and secretes itself under a small web on the under surface of the leaves of plants, and is a small insect.

SIGNATA. Greenish; sides of the thorax black; abdomen with two black lines. It inhabits Kiel, in Germany.

MACTANS. Abdomen ovate, black, with a scarlet dorsal line. This is an American insect. There is a variety whose abdomen is distinguished with two pair of scarlet dots, and a tail.

CICUREA. Pale red, with a cinereous ovate abdomen. This inhabits Germany, and is found in houses.

BICORNIS. The insects of this species are yellowish; the abdomen is depressed, with six impressed dots; the head is two-horned. It inhabits Tranquebar.

NIGRITA. Black; abdomen with two testaceous dots beneath. It inhabits Saxony, and is middle-sized.

CORNUTA. Brown; abdomen oval, cylindrical, above yellowish-white, with four pair of impressed dots and four parallel grey lines behind. This is found in America. It is about the size of a man's finger; the legs are long; the thorax truncate on each side, and ending in two small horns behind.

B. Eyes placed

* **GLOBOSA.** Black; abdomen globular, with crimson sides. It is found in the woods of England and other European countries. The body is very small: the abdomen with an interrupted white band in the middle; the legs are black; the hind ones are the longer.

C. Eyes placed

HORRIDA. Abdomen nearly triangular, the tip truncate and obtuse, the four front legs are the longer. It inhabits Germany, under the leaves of plants, and has a retrograde motion; it is of a singular formation.

MAXILLOSA. Ferruginous, with a greenish abdomen; the legs are pale; the mandibles large and projecting. It inhabits the island of Santa Cruz.

SMARAGDULA. Green; abdomen paler, with a green dorsal line at the base. It inhabits France.

LATRO. Thorax villous, cinereous; abdomen acute, black, with ferruginous spots. It inhabits America.

* **VIATICA.** Brown, with a roundish flat obtuse abdomen; four hind-legs very short. It inhabits Europe, in gardens and meadows, and is small.

* **DOMESTICA.** Abdomen ovate, brown, with five black and nearly contiguous spots, the anterior ones larger. It inhabits Europe, is very common in houses and about windows; it preys chiefly on flies.

DORSATA. Green; abdomen brown on the back. It inhabits Kiel.

TESTACEA. This is testaceous; the abdomen is sub-

globular, dull greenish. It is found in divers of the South American islands.

* **TRILINEATA.** Abdomen ovate, whitish, with three longitudinal lines of blackish dots.

IMPRESSA. Black; abdomen ovate, with six impressed dots, and two yellow dots beneath. It inhabits Norway, on rocks.

* **LEVIPES.** Abdomen rhomboid, depressed, and spotted with black; the legs are extended and variegated. It is found on walls in this country, and other parts of Europe.

TRICUSPIDATA. Greenish; abdomen white, with a reddish tail. It inhabits Saxony. Head, thorax, and legs greenish; eyes, especially the latter ones, elevated.

D. Eyes placed

ARGENTATA. Abdomen white, and brown behind; the margin six-toothed. It inhabits America and the East Indies. Thorax silvery, the margin of the abdomen is armed with three strong spines on each side.

E. Eyes placed

FASCIATA. Silvery; abdomen with a yellowish band; legs annulate with brown. It inhabits Madeira.

* **ANGULATA.** Abdomen ovate, the sides angular and acute on the fore-part; the thorax has an excavated centre. It inhabits our own country, and divers other parts of Europe, in trees, and spins a web, which is perpendicular in its position, and which varies very much in colour.

* **DIADEMA.** Reddish-brown; abdomen gibbous, and marked with white drop-shaped spots in the form of a cross. This is found in our own country in trees, and is reckoned a very beautiful insect. The body varies much in colour from a darker to a lighter reddish-brown; the legs are annulate with brown.

MARMOREA. Brown; abdomen ovate, varied with white and brown; found chiefly on the European continent. Spins its web on the ground; the legs are yellow, annulate with brown.

RETICULATA. Abdomen globular, reticulate, above purplish, clouded with brown, found chiefly in the gardens in Europe.

* **CUCUREBITINA.** Abdomen subglobular, yellow, with a few black dots. It belongs to this and other European countries, is found in trees, and spins a lax web.

CALYCINA. Abdomen globular, pale yellowish. This is an European insect, and is found in the calyces of flowers from which the coral has fallen, and fastens on bees and flies that come to extract the nectar.

8-PUNCTATA. Abdomen roundish, yellow, with four black raised dots on each side; tail rufous. It inhabits Sweden, and is thought by some writers not to belong to this division.

BI-PUNCTATA. Abdomen globular, black, with two hollow dots. It is found chiefly in windows in European countries.

RIPARIA. Abdomen ovate, black-bronze; tail pale yellow, and two-horned. It inhabits Sweden, on gravelly shores.

* **QUADRATA.** Abdomen subglobular, yellowish-rufous, with a white line at the base and four spots. It inhabits the woods of Europe. It is somewhat less than the diadema, and perhaps only a variety of it.

LITURATA. Testaceous; abdomen pale black, with a white margin and marks. Inhabits France.

QUADRI-PUNCTATA. Abdomen oblong; the back black and

SPIDER.

and flat, with four excavated dots. It inhabits Europe, in houses.

MILITARIS. Black; with four spines, the hind ones longer and spreading. This is an American insect, as are the three following.

SPINOSA. Back with eight spines, the two hind ones spreading; abdomen beneath conic. The body is brown, and of a triangular shape.

ACULEATA. Back with six spines, the hind ones spreading.

TETRACANTHA. Abdomen globular, with four spines round the margin. The head and thorax are ferruginous; abdomen with impressed dots at the base.

HEXACANTHA. Abdomen transverse, with six spines round the abdomen. This inhabits Jamaica, and is supposed to be the same, or at most a variety of the cancriformis.

FORNICATA. Sides of the abdomen a little vaulted, with two spines, the posterior one longer. It is found in New Holland. A specimen exists in the museum of Sir Joseph Banks.

* **LABARIUTHICA.** Abdomen ovate, brown, with a whitish pinnate line. It spins an horizontal web on the ground, with a cylindrical cavity.

QUADRI-LINEATA. Abdomen roundish, yellow, with a purplish line on each side, and four dots. It inhabits Sweden. It is hyaline, with a yellow front.

* **REDIUSITA.** Abdomen oval, pale yellow, with a crimson oval crown or ring on the back. It is found in gardens. The legs are long, white, and transparent.

COROLLATA. Abdomen oval, black, with a white oval ring on the back. It inhabits Europe, on plants.

* **MONTANA.** Abdomen oval, white, with grey spots. It inhabits Europe, on trees. The thorax and legs are pale; the fore-legs are long and extended.

SANGUIOLENTA. Abdomen ovate and scarlet, with a longitudinal black line. It inhabits Spain.

NIGRA. Abdomen ovate, and scarlet above. This is an inhabitant of Calabria.

NOTATA. Abdomen ovate, brown, with white transverse curved lines. Found in divers parts of Europe, as are the three following.

RUFIPES. Abdomen brown; legs rufous. Found chiefly on nettles.

NOCTURNA. Abdomen black, with two white dots, and a white lunule at the base.

SEX-PUNCTATA. Abdomen oblong, with three pair of excavated dots.

PALUSTRIS. Thorax and abdomen with a snowy line on each side. Found in the reedy marshes of Germany. The tip of the thorax before the eyes ends in a white line.

* **AQUATICA.** Brown; abdomen ovate, cinereous; the back brown, with two impressed dots. This is found in our own and other European countries, in fresh-water lakes, where it dives to the bottom in search of food, within a globule of air formed by itself. It takes up its winter quarters in a forsaken shell, the aperture of which it closes up with a web. Its jaws are large, strong, black, with scarlet nails.

OBSCURA. Abdomen subconic, dusky, with a whitish dorsal line. It inhabits France, in woods, as does the next.

SCALARIS. Thorax testaceous; abdomen snowy on the back, with an oblong indented snowy spot at the tip.

TRIGUTTA. Yellowish; abdomen black, with three white spots. Found in Alsace.

SCORPIFORMIS. Black; abdomen whitish, with two

black lines; fore-legs very long. Found in gardens at Leipsic. It is small and retrograde.

* **CARNIFEX.** Ferruginous; abdomen grey, with a dorsal line. It inhabits England.

FLAVISSIMA. Abdomen oblong, of a fine rich yellow colour, and smooth. Found in Egypt.

BIMACULATA. Abdomen roundish, chestnut-brown colour, with two white dots. It inhabits Europe, and is less than a flea.

TRUNCORUM. Black, with white dots on the back. It springs to a great distance on its prey. It is an European insect, and found on walls and the trunks of trees.

RUPESTRIS. Abdomen with a black spot, edged with red, and white in the middle. It springs on its prey, and is found chiefly on old walls.

VIRESCENS. Abdomen oblong, yellow-green, with lateral white lines.

SPINIPES. Pale, with spinous legs. A variety has spinous legs, with ferruginous joints. Found in divers parts of Europe.

OPILIONOIDES. Grey, with very long and extremely slender legs. It inhabits Germany and France; spins a very lax irregular web, the threads crossing each other; and is gregarious.

OSBECKII. Pale yellow; abdomen with impressed dots in pairs, with an odd one; the fore-legs are longer. It inhabits Austria, as does the next.

WILKII. Varied with black and grey; legs cinereous, annulate with black; the hinder ones are shorter.

SPECIOSA. Thorax grey, with two brown spots; the abdomen is oval-oblong, with transverse black curves; beneath it is reticulate with black, with two yellow bands. It inhabits Calabria and Siberia, and is domesticated in the houses of the Cossacks. It is a very beautiful species.

F. *Eyes placed*

CLAVIPES. Abdomen oblong, yellow, dotted with white; all the shanks, except the third pair, clavate and hairy. It inhabits South America, in trees and out-houses; spins a strong spreading web, and is a beautiful species.

* **SACCATA.** Abdomen ovate, rusty-brown. This is found in gardens, and it carries its bag of eggs behind it.

FUMIGATA. Abdomen ovate, brown, with two white dots at the base. This is found in Sweden. It lives in meadows, and watches before the nests of larvae, which it catches as they come out, one after another, and sucks out their vitals.

G. *Eyes placed*

FIMBRIATA. Black; abdomen oblong, with a white line on each side. It is found in many parts of the continent of Europe, in reedy marshes.

* **DORSALIS.** Black; thorax compressed, with a white dorsal line. It is common in England. The abdomen is ovate, whitish at the base; the legs are livid.

SANGUIOLENTA. Black; abdomen red, with a black dorsal line. It is found in divers parts of Europe, and springs on its prey.

PUPILLATA. Testaceous; abdomen brown on the back, with subocellar fulvous spots. It inhabits China.

* **SCENICA.** Black; abdomen subcylindrical, with three femicircular white lines on each side. It springs on its prey. It inhabits this and other countries of Europe, on old walls and windows. The body is covered with silvery hair; the legs are short, hairy, black and white.

FULVATA.

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FULVATA. Black; hind margin of the thorax fulvous; abdomen with three fulvous bands. It inhabits Cayenne.

PUBESCENS. Abdomen ovate, brown, with four cinereous spots, the hind ones larger. It inhabits Leipzig.

CINEREA. Cinereous; abdomen brown on the back, with eight cinereous dots. It is found on the shores of the Baltic.

TRILIENATA. Brown; thorax with a paler margin, and lateral dorsal line; abdomen ovate, cinereous; beneath brown. It inhabits Naples.

TARANTULA. Abdomen with triangular black spots on the back; the legs are spotted with black. This is found in the southern parts of Europe, but chiefly in Italy, and likewise in Barbary, in cool caverns, and is the insect whose bite was long supposed to be curable by music only. It is generally admitted to be partially poisonous, but never fatal. See **TARANTULA.**

H. *Eyes placed* : : :

AVICULARIA. Thorax orbicular, convex, with a transverse central excavation. Found among trees in South America, where it preys upon larger insects, and even upon small birds, dropping into their nests, and sucking their blood and eggs. It is said to be of so enormous a size, that its fangs are equal to the talons of a hawk; and its eyes are capable of being set in the manner of glasses, and used as microscopes.

I. *Eyes placed*

PULCHRA. Oval-oblong; thorax villous, white; abdomen and legs black, with yellow bands. It inhabits Helvetia.

K. *Eyes placed* : :

GOEZII. Black; abdomen ovate; front white. It springs on its prey, and is usually found in the woods of Vienna. The abdomen is marked with two impressed dots.

L. *Eyes placed* : : . . .

TRUNCATA. Grey, ferruginous, slightly clouded; thorax globular, and slightly heart-shaped; the abdomen is something triangular, and marked with an obsolete longitudinal cross. It is found in Germany, on oak and other trees.

M. *Eyes placed* : : : :

CONICA. Abdomen ovate, obscurely conic behind, varied with brown and whitish, and black beneath. This, like the last, is found in the woods of Germany, and spins a labyrinthical web.

N. *Eyes placed* :

ALBIFRONS. Hairy; body ovate, and variegated with black and chestnut-brown. It inhabits Luface.

O. *Eyes placed* : : : :

TAURUS. Abdomen flat, with two very long curved spines. Found chiefly at St. Domingo.

ARCUATA. Brown; abdomen with six spines, the middle ones curved, and six times as long as the body. This is found in the East Indies, and is a small insect.

MAGULATA. Thorax silvery; abdomen cylindrical; legs very long and black. It inhabits China.

PILIPES. Brown; abdomen cylindrical, with silvery lines; legs very long and hairy. It inhabits the East Indies, and is a large insect.

MYOPA. Greenish; abdomen red on the back, with a few black dots; the sides are yellowish. It inhabits Kiel. This is a beautiful insect; the mandibles are tipped with black; the thorax with two darker lines; abdomen ovate, pubescent; textorial papillæ tipped with black; legs long, pale greenish; the fore-shanks tipped with black.

LONGIPES. Black; abdomen cylindrical, brown, with six impressed dots; the legs are very long. It inhabits Australasia.

RUFIPES. Ferruginous; abdomen ovate, pale cinereous; legs rufous. It inhabits Morocco.

***SENOCLATA.** Abdomen greenish, with black dots, and a yellow line on the sides. It is found in gardens and on walls.

SCOPULORUM. Abdomen brown, with a pinnate white dorsal line. It inhabits Norway, and is found on rocks.

LUSEA. Pale; abdomen silvery, with black branched lines. It inhabits Traquebar.

PARALLELA. Brown; sides of the thorax and abdomen white; mandibles projecting and parallel. It inhabits the American islands.

SCROFA. Hairy, brown; abdomen semi-orbicular; mandibles black, exerted, and hooked at the tips. It inhabits under ground at Chili, and is about the size of a pigeon's egg.

BICORNIS. Abdomen two-horned. It inhabits Siberia.

CASPIA. Thorax subglobular; abdomen oblong, varied with yellow and black bands. This species inhabits the deserts of Ural, and is regarded by the Calmucks as venomous.

ARGENTEA. Thorax orbicular, depressed, white, with two black fillets; abdomen is ovate, lobed, silvery, with two pair of dots in the middle, and four rows behind. It inhabits the deserts of Ural, and is accounted poisonous by the Calmucks. It spins a perpendicular web.

P. *Number and Position of the Eyes unknown.*

NOBILIS. Thorax orange, with six black spots; abdomen yellow, with seven black spots. It inhabits Sumatra.

CALCEATA. Hairy, grey; legs with two black spots at the tip above; beneath silky, with a green gloss. It inhabits Guinea, and is a very large insect.

***HOLOSERICEA.** Abdomen ovate-oblong, silky, livid brown, with two yellow tubercles beneath.

SPINIMOBILIS. Abdomen roundish, yellowish-brown, with four rows of blackish dots; thighs with black movable spines. This is found at Surinam.

CRUENTATA. Black, with a yellow band at the base of the abdomen; the breast is of a deep red. It inhabits Brazil.

SEX-CUSPIDATA. Brown; back of the thorax six-toothed, with a lateral fulvous spot. It inhabits the Cape of Good Hope.

HIRTIPES. Black; feelers and legs hairy, and pale testaceous. It inhabits Cayenne.

TRIBULUS. Head three-toothed on the fore-part, abdomen covered with numerous spines. It inhabits the Cape of Good Hope.

ELEGANS. Black, with two white curves on the fore-part of the thorax, and a white dorsal line on the abdomen. This is an American insect.

OCELLATA. Pale; abdomen clouded, with a black ring; the thighs are marked with three doubled ocellate spots.

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spots. It inhabits China, and is the size of the tarantula.

ALBA. White; abdomen with five impressed dots; two-horned and depressed at the base, and globular at the tip. It inhabits Siberia, under the bark of trees.

The eggs of some spiders are a very pleasing microscopic object; they are round at one end, and flattish at the other, with a depression in the centre of the flattish end, and a yellowish circle round it. The colour of these eggs is a pearly or blueish-white, and when the young spiders hatch, they come out in their perfect form, and run about very nimbly.

The female spider deposits her eggs, to the number of five or six hundred, in a bag composed of her own web, which she either carries under her belly, or hides in some very safe recess. *Philos. Transf. N^o 272.*

The young spiders are always very beautiful objects for the microscope. The current of the blood may be easily discovered in their legs, and part of their bodies; and many other curious particulars occur in their dissection. There are two or three species of this animal particularly worthy the attention of the curious in microscopic discoveries. 1. A little white field spider with short legs. This is found plentifully among new hay, and its body appears like white amber with black knobs, out of which grow short but sharp prickles. The eyes of these may be very distinctly seen, being very brisk and lively, and some have six, some eight of them; each eye has a pupil of a violet blue, which is beautifully clear and transparent, and is surrounded by a circle of pale yellow. 2. The wandering, or hunting spider, that spins no webs, but runs and leaps by fits. This has two tufts of feathers fixed to its fore-paws, which make a very beautiful appearance before the microscope. The variety and beauty of colouring also, all over this little creature, afford a very pleasing sight. 3. The *long-legs*, or shepherd spider. This is a most wonderful creature: it has two fore-claws at a great distance from the head, tipped with black, like those of a crab, and opening and shutting like the scorpions; these are serrated or indented on their inside. When all the legs are cut from this spider, and it is examined by the microscope, it will be seen that the protuberance on the top of its back is furnished with two fine black eyes. *Power's Microf. Obs. p. 13. Hook's Microgr. p. 200.*

The venom of many kinds of spiders is greater than usually supposed: we have, in the *Philosophical Transactions*, an account of a person in New England who was bitten by a small spider a little above his ankle; he perceived the creature biting, and crushed it to death upon the wound, between his stocking and his leg; in half an hour he felt a pain in that leg, which in another half hour extended itself to the groin, and at the same time he had a creeping pain in the calf of his other leg; and in a quarter of an hour after this it affected his stomach, his back, and his head. The pains were not constant and fixed, but erratic, and very acute, and his pulse was extremely low and heavy. He was relieved, by taking internally spirit and salt of hartshorn in viper-wine, and applying a cataplasm of garlic to the part, and in three or four days wholly recovered.

Boccone mentions a species of large spider, common in the island of Sardinia, whose bite proves mortal within the space of a few hours; the whole body usually swells almost immediately, in consequence of this bite. The cure is performed by oil of olives, in which the creature is infused over the heat of a stove. This is a medicine they always keep ready in the house, and while they use this externally, they give large doses of Venice treacle inwardly, dissolved in strong wine: but many die of this bite, either from the

want of power in the remedies, or from their being used too late.

There is hardly any subject on which there has been a greater difference of opinion than the supposed poison of spiders. To the observations that occur in this article and also under *ARANEÆ*, we shall here add some further remarks, with which we are furnished by Dr. Amoureux, jun. a late French writer. Our spiders in France, says this author, (in his "Notice des Insectes de la France réputés venimeux,") are in general rather ugly than formidable. If any are suspected of being poisonous, it ought not to be the domestic spider with long claws, *aranea phalangiodes*, Linn., nor the mower of the fields, *phalangium opilio*, Linn., the only kinds of the phalangia mentioned by Geoffroy; nor the mason spider, nor the orange-coloured spider, and that entirely white *aranea viatica*, and the *aranea citrina*, Linn., found commonly among vegetables or fruit, and chiefly grapes, nor many others, which we see daily, and of which we have no cause to complain. Swammerdam did not believe that the spider emitted through the stings or darts with which it pierces the animals whose blood it sucks, a venomous liquor. Lister, on the other hand, who says that he had certain proofs of spiders being venomous, expressed the poison from these instruments. *Leuwenhoeck* also advances, that the venom of the spiders is contained in the cavity of the sharp pincers which proceed from the mouth of the insect. Others have said that these forceps are not hollow, but that the venom proceeds from a small trunk which issues from the mouth at the moment when the insect seizes its prey. (See *ARANEÆ*.) Although it be a certain fact, that many spiders, and perhaps all of them, throw out from their mouth a certain liquor, with which they moisten their prey, we may rest assured, says Amoureux, that our spiders have nothing in them of a venomous nature; and this is proved by their being often touched without danger, and by their being eaten without injury. Redi saw people who ate spiders, and from the experiments which he made, he does not believe them to be poisonous. Clark and Roefel maintain, that spiders are not so venomous as is supposed, since many persons swallowed them. A person is mentioned, who ate all he could find, and who found them to be purgative. He spread them on a slice of bread, as if they had been excellent marmalade. Moreover, it is maintained, in opposition to the popular error, that the spider is not able, by its pricking, to kill the toad. It is also well known, that chickens, nightingales, and other birds, eat spiders without injury; and they have been prescribed as a remedy chiefly in the tympanis. Lister, whose observations on these insects have been numerous, says positively, that several spiders have a venomous liquor: but the honorable Mr. R. Boyle assures us, that he never saw any venomous spiders in Ireland. Upon the whole, it is observed, the different effects of spiders are owing partly to a difference in the spiders on which experiments have been made, and the different constitution of the subjects. In ordinary cases of being bitten or punctured by spiders, it will be sufficient to wash the wounded part with brine, to apply theriaca, and to prescribe one or two doses internally. The fresh leaves of sage, or those of plantain, have been recommended as topics, and washing with vinegar. Recourse may also be had to volatile alkali.

Some think the white matter we often find floating in the air towards the end of summer, is produced by spiders. See *Air-THREADS*.

SPIDER, Red. See *ACARUS*.

The red spider is very injurious and destructive to different sorts of plants and fruit-trees, especially in forcing-houses

houses. It is found particularly so to those of the forced French bean, melon, peach, vine, cherry, currant, and some other kinds. The generation and production of this insect are greatly caused and promoted by the dry warm heat that is constantly kept up in the houses which contain these sorts of plants and trees, and there are many other circumstances which combine in bringing it forth. It is an insect which has no wings, and the female is oviparous.

Several different methods have been attempted in order to the removal and destruction of it. Constant daily watering, or washing the trees, are said to have the power of subduing it, but in the execution of the work, care is always to be taken that every part of the leaves be wetted, otherwise the insects shelter and save themselves in the dry parts, and are preserved from the effects of the water.

Moisture conveyed in some way or other is certainly found to be the most destructive, of any thing yet discovered, of these pernicious insects, as well as many others that infest hot-houses. Throwing weak lime-water in a plentiful manner on the under sides of the leaves, where these insects are commonly found, will, for the most part, soon destroy them.

The following directions have been given for the destruction of this sort of spider, when it becomes injurious to melon plants; and the same may probably be found useful for those of the forced French bean, and some other similar kinds.

In cases of dry weather, and with a dry heat, melon plants are very subject to be infested with the red spider; and the appearances of it may constantly be long noticed before the insects can be seen with the naked eye, by the leaves beginning to curl and crack in their middle parts. Whenever they are discovered to be in this state or condition, and there is fine warm sunny weather, the watering of them all over the leaves, both on the under and upper sides, is advised; a watering-pot, with a rose finely perforated with holes, or a garden-engine, which disperses the water in a fine dew-like manner, being employed for the purpose. The work should be performed about six o'clock in the morning, and the plants be shaded with mats about eight, if the sun shine with much power, shutting the frames down closely until about eleven; and then admitting a small quantity of fresh air, letting the mats remain until about three in the afternoon, when they should be wholly taken away. The shade which is thus afforded by the mats prevents the leaves of the plants from being scorched or otherwise injured by the action of the heat of the sun while they are in a wet cooled down state. Where a southerly breeze prevails, watering them again about three in the afternoon is recommended, shutting them up close as before, to keep the heat in, which causes a strong exhalation of the moisture, and is greatly destructive of the spiders.

In all these waterings, the water is to be thrown as much and as finely as possible on the under sides of the leaves, where the insects mostly lodge; the vines or stems of the plants being gently turned in that intention, taking great care not to injure them, by which means the water is capable of being easily thrown over the whole of the under sides of the leaves, it being done in a gentle manner, in the modes already suggested, so as not to wash up the mouldy matters on to the plants: the lights and sides of the frames which contain the plants, should also, at the same time, have water plentifully thrown on and against them. When these waterings are finished, the vines or stems of the plants are to be carefully laid down again in their former positions. And if the day be sunny, the mats may be let remain, as already directed, until the leaves of the plants become perfectly dry, air being admitted according to the heat that may be present

at the time. It is likewise further advised as a precautionary measure, that, before the frames and lights, which are to contain plants of this sort, are employed, they should be well washed, both inside and out, first with clean water, and then with a mixture of soap-suds and urine; a brush or woollen rag being made use of in the operation; as by this method the ova or eggs of the spiders or other insects that may have been deposited and lodged in or on them, in the preceding season, may be cleared away and destroyed. The exhalations of the water which has been thrown upon the plants, and the frames or boxes that contain them, may also be useful in killing these insects, in other cases by keeping them in a close state.

These washings should never, however, be performed in cold frosty periods or seasons; and the water made use of in such cases should always be of the rain or soft kind.

The mould which has formerly been employed in raising these plants, where infested with the spider, should not, on any account, be again had recourse to for the same use, as it may contain the ova of these insects. See CUCUMIS.

The waterings, washings, and other modes and means of removing and destroying this insect, when it infests the fruit-trees and shrubs noticed above, are explained under the different proper heads. See AMYGDALUS, PRUNUS, RIBES, and VITIS.

The species of this genus of insects are extremely numerous, being more than eighty. This sort is very common on trees, especially those of the currant kind, being frequently seen running on the fruit of it. See ACARUS.

This insect is injurious and destructive to plants and trees, and the production of their fruits, by feeding on their juices; as the stems and leaves of them are not unfrequently completely robbed and exhausted of their moisture in this way.

SPIDER'S Silk. See SILK, and ARANEA.

SPIDER'S Web. See WEB.

SPIDER-Shell, a name given to some species of the murex.

SPIDER-Wort, in Botany. See ANTHEMICUM.

SPIEGELBERG, in Geography, a town and citadel of Westphalia, giving name to a small county in the principality of Calenberg; 21 miles S.W. of Hanover.

SPIEI, in the Glass Trade, an iron instrument, hooked at the end, and pointed, with which the workmen take the metal up out of the melting-pots for proofs or assays, to see whether it be fit to work.

SPIELBERG, in Geography, a town of Germany, in the principality of Oettingen, insulated in the margravate of Anspach; 8 miles N.E. of Oettingen. N. lat. 49° 3'. E. long. 10° 13'.—Also, a town of Germany, in the principality of Culmbach; 3 miles E.S.E. of Kirch Lamitz.

SPIELMANNIA, in Botany, named in honour of Dr. John Reinhold Spielmann, professor of medicine and botany at Strasburg, author of a *Prodromus Floræ Argentoratensis*, and other tracts on botany and pharmacy.—“*Medicus Act. Palat. v. 3. 196. t. 10.*” Schreb. 414. Willd. Sp. Pl. v. 3. 321. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 4. 45. Juss. 109. Lamarck Illust. t. 85.—Class and order, *Didynamia Angiospermia*. Nat. Ord. *Personate*, Linn. *Vitices*, Juss.

Gen. Ch. Cal. Perianth inferior, of one leaf, erect, short, permanent, divided into five, linear-awl-shaped, acute, nearly equal segments. Cor. of one petal, salver-shaped: tube cylindrical, incurved, globular at the base, hairy within-side, its mouth closed with hairs; limb nearly equal, cloven into five oblong, truncated, flat, widely spreading segments. Stam. Filaments four, very short, in the tube of the corolla, two of them shorter; anthers oval. Pist. Germen superior, roundish; style short, permanent; stigma hooked.

Peric. a globular, one-celled, succulent drupa. *Seed.* Nut globularly depressed, wrinkled, striated and tuberculated longitudinally, two-celled. Kernels solitary, oblong, more gibbous outwardly, tuberculated and striated longitudinally, each affixed to a fleshy tunic, gibbous on one side, hollow on the other, adhering to the partition.

Eff. Ch. Calyx five-cleft. Limb five-cleft, its mouth closed with hairs. Stigma hooked. Drupa containing a two-celled, tuberculated nut.

1. *S. africana.* Ilex-leaved Spielmannia. Willd. n. 1. Ait. n. 1. (*Lantana africana*; Linn. Sp. Pl. 875. *Jafminum africanum*, *ilicis folio*, flore solitario ex alis foliorum proveniente; Commel. Rar. 6.)—Native of the Cape of Good Hope.—It flowers from February to November.—*Stem* shrubby, five or six feet high, sending out numerous irregular branches. *Leaves* oval, thin, embracing the stem, serrated, pointed, viscid, fragrant; upper ones alternate. *Flowers* solitary, one from the bosom of each leaf, white, somewhat resembling those of *Jessamine*. *Fruit* globular, inspid.

Adanson long ago formed a new genus of this plant, which he called *Ostia*.

SPIERINGS, N., in *Biography*, born at Antwerp in 1633, was a painter of landscape, who formed his style on the study of the works of Salvator Rosa, and particularly remarkable as one of those who produced a portion of the numberless pictures sold as his all over Europe.

SPIETZ, in *Geography*, a town of Switzerland, in the canton of Bern, situated on the W. coast of the lake of Thun; 25 miles S.S.E. of Bern. N. lat. 46° 41'. E. long. 7° 33'.

SPIGELIA, in *Botany*, so called by Linnæus in commemoration of an old botanist, of considerable note, Adrian Spigelius, who was born at Brussels in 1578, and who died at Padua, where he was professor of anatomy and surgery, in 1625. His work, entitled *Isagoge in rem herbariam*, appeared at Padua in 1606, and another edition at Leyden in 1633. (See SPIGELIUS.)—Linn. Gen. 84. Schreb. 110. Willd. Sp. Pl. v. 1. 824. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 1. 317. Juss. 143. Pursh N. Amer. 123. Lamarck Illustr. t. 107.—Class and order, *Pentandria Monogynia*. Nat. Ord. *Stellatae* β, Linn. *Gentiana*, Juss.

Gen. Ch. Cal. Perianth inferior, of one leaf, deeply five-cleft, pointed, small, permanent. Cor. of one petal, funnel-shaped; tube much longer than the calyx, narrowed towards the base; limb spreading, cloven into five broad, pointed segments. Stam. Filaments five, simple; anthers simple. Pist. Germen superior, composed of two globes; style solitary, awl-shaped, the length of the tube; stigma simple. *Peric.* Capsule two-lobed, of two cells and four valves. *Seeds* numerous, very minute.

Eff. Ch. Corolla funnel-shaped. Capsule of two globular cells, with many seeds.

1. *S. Anthelmia.* Annual Worm-grafs. Linn. Sp. Pl. 213. (*Anthelmenthia quadriphylla*; Brown Jam. 156. t. 37. f. 3.)—*Stem* herbaceous. Upper leaves in fours.—Native of the West Indies and South America. It flowers in July.—*Root* annual, fibrous. *Stem* herbaceous, a foot and half high, channelled, branched. *Leaves* opposite, in pairs, those which terminate the branches four together in the form of a cross, ovate, pointed. *Flowers* in short, herbaceous, clustered spikes, ranged on one side of the footstalk.

2. *S. marilandica.* Perennial Worm-grafs. Willd. n. 2. "Hope Act. Edin. 1771, v. 3. 151. t. 1." Curt. Mag. t. 80. Woodv. Med. Bot. 288. t. 105.—*Stem* square.

Leaves all opposite.—Native of North America, on the edges of woods, in rich moist situations, flowering in July and August.—*Root* perennial, fibrous. *Stems* herbaceous, erect, six or eight inches high. *Leaves* opposite, sessile, entire, smooth, spreading. *Flowers* large, and extremely handsome, in a terminal spike, all on one side of the footstalk, of a bright red or rich scarlet on the outside, yellow or orange-coloured within.

The English name of this genus, Worm-grafs, is derived from the peculiar efficacy of both the species as a medicine for persons afflicted with worms. Dr. Brown, in his History of Jamaica, says that no other simple is equally efficacious with *S. Anthelmia* for this purpose, and Mr. Pursh informs us that the roots of *S. marilandica* are in great estimation, and sold under the name of *Pink-root*.

SPIGELIA, in *Gardening*, comprises plants of the annual and perennial kind, the cultivated species of which are, the American worm-grafs (*S. anthelmia*), and the Maryland worm-grafs (*S. marilandica*).

Method of Culture.—The first sort, which is annual, and not hardy in its nature, is increased by sowing the seeds of it upon a hot-bed, or in small pots plunged into one, in the early spring season, treating the young plants afterwards in the manner of those of the tender annual sort.

In the second species, which is perennial, and somewhat hardy, as it does not ripen its seeds well in this climate, it must be propagated by parting the roots in the autumnal or spring months, and putting them in separate pots, or placing them out in warm situations.

The latter kind of these plants, which have the outsidings of their flowers of a bright red colour, and the insides of a deep orange cast, produce a fine ornamental effect, as they make an elegant and beautiful appearance during the summer months, when placed in collections with others.

SPIGELIA, in the *Materia Medica*, the root of the spigelia marilandica, or worm-grafs root, imparts its bitter taste to boiling water. It is purgative and anthelmintic; the latter property having been discovered by the Cherokee Indians, who call it "Unstretta," and many opportunities having occurred in this country, as well as America, for evincing its efficacy in worm cases. In the recent state, and administered in small doses, it occasionally produces giddiness, dimness of sight, and even convulsions; and these effects are ascribed to its narcotic principle, the action of which its powerful cathartic property prevents, when the dose is large. It is usual to administer an emetic previous to the use of it; and to assist its purgative operation by adding two or three grains of calomel, or eight or ten of rhubarb. Its power in expelling lumbrici has been most perceptible; and in vinous infusions of it, it is said to have been beneficial in intermittents. Dr. Barton also recommends it in the protracted remitting fever of infants, which often lays the foundation of hydrocephalus. This root may be administered either in substance, or in the form of aqueous infusion. The dose of the pulverized root may be from grs. x to 3j, given every night and morning till the worms are expelled. Woodville. Thomson.

SPIGELIUS, (or VANDEN SPIEGHIEL,) ADRIAN, in *Biography*, an eminent physician, was born at Brussels in 1578. He studied philosophy and medicine first at Louvain, and afterwards at Padua, where he received the degree of M.D. He became thoroughly skilled in every branch of his profession, and particularly in anatomy and surgery; and after travelling for some time to the different schools of Germany, he settled in Moravia, where he was soon appointed physician to the states of the province. He had there attained to the highest reputation, when he was invited,

in 1616, by the senate of Venice, to occupy the principal professorship of anatomy and surgery in the university of Padua, which had become vacant by the death of Caserius. He accepted the appointment, and acquitted himself with so much success, that he contributed to render the schools of Padua more flourishing than they had ever been; and the senate recompensed his services by creating him a knight of St. Mark, and presenting him with a collar of gold. The apparent vigour of his constitution, his vivacity of disposition, and his years, promised a continuance of life, and an increasing reputation; but he was cut off at the age of 47, in April 1625; according to one account, in consequence of a puncture of his finger by a piece of glass, at the marriage-feast of his daughter, which was followed by a suppurating tumour in the axilla; but according to another, in consequence of an attack of slow fever, brought on by his indefatigable exertions in the performance of his duties. His writings evince that he was a man possessed of very extensive medical knowledge. The first work which he published was entitled "Ifagoges in Rem Herbariam Libri duo," printed at Padua in 1606. This work, though not very systematic, contains some interesting matter. It treats copiously on the virtues of plants, respecting which he is said to have learned much from the Italian peasantry, in a tour which he made in the dress of a rustic. He published also "De Lumbrico lato Liber, cum notis et ejusdem Lumbrici icone," to which was subjoined a letter "De incerto tempore Partus," 1618. "De Semitertianâ Libri quatuor," Francf. 1624. But the most valuable of his writings are those which he composed on anatomical subjects, and which were published after his death by his son-in-law, Crema. These were entitled "De Humani Corporis Fabricâ Libri X, cum Tabulis 98 ære incisif," 1625, folio; and "De formato Foetu Liber singularis, æneis figuris ornatus;" to which was annexed "Tractatus de Arthritide," 1626, folio. The first of these, relating to the structure of the human body, is one of the best anatomical works of the time, written with purity, and arranged with great perspicuity and precision, and containing useful physiological and practical observations. There is an edition of this work published by Bucetius, 1627, who has been censured for intermixing his own observations with the text of the author. The whole works of Spigelius were collected by Vander Linden, and published in three volumes folio, at Amsterdam, in 1645. See Eloy Dict. Hist. de la Med. Gen. Biog.

SPIGNET, in *Botany*. See ATHAMANTA.

SPIGNET, *Meu*. See ÆTHUSA.

SPIGNET, *Wild*. See SERMOUNTAIN and SESELI *Seed*.

SPIGNO, or SPINA, in *Geography*, a town of France, in the department of the Stura, late a marquissate belonging to Piedmont, on the Belbo; 9 miles S.S.W. of Acqui.

SPIGOLA, in *Ichthyology*, a name given by Paulus Jovius, and some others, to that species of perch which is generally called the *lupus marinus*.

It is a genuine perch, and is distinguished from the others by Artedi, by the name of the perch with thirteen rays in the second back fin, and fourteen in the pinna ani.

Authors have called two different fish by this name *lupus marinus*, which, conveying no distinct idea of the characters of the fish, was applicable to one as much as the other: but this name of Artedi admits of no equivocation, and must always distinguish the fish.

SPIKE, in *Geography*, an island in the harbour of Cork, Ireland, which commands the entrance in such a manner, that it has been regularly fortified at a great expence, and is one of the most complete and unassailable fortresses in his

majesty's dominions. The works, now (1815) nearly completed, have given employment to a great number of men for several years. Spike island is immediately opposite to the town of Cove, and about ten miles from Cork.

SPIKE, or *Oil of Spike*, a name given by our druggists to an essential oil, much used by the varnish-makers and the painters in enamel; and of some use in medicine.

This oil, when genuine, is brought from Provence, and some other parts of France, and is there made of lavender. This plant is called in Provence *aspic*, and thence came the name *oil of aspic*, which afterwards degenerated into *oil of spike*. See LAVANDULA, and OIL.

The manner of making the oil upon the spot is this: when the flowers are perfectly ripe, they put them into an alembic with a great quantity of water, and this they distil: after several days' maceration, there arises with the water a large quantity of an oil of a fine pale amber colour, and this, separated from the water, is the true and genuine oil of spike.

The flower of this plant is the part which yields the largest quantity of oil; as is the case with all the plants with galeated flowers, of which the husk, or flower-cup, usually contains almost all the oil of the plant. The aromatic plants, in general, yield indeed but a small quantity of oil, but the vast abundance of this plant, in these places, makes the expence of gathering it so small, that the oil is very cheap. The quantity required on several occasions, is, however, much greater than what all the lavender of the country can yield; and the price it is expected to be sold at is so small, that it is not to be wondered that there are several common adulterations of it.

The most useful ways of sophisticating it, however, are two; the one with the spirit of wine, which is esteemed the least hurtful, and the oil thus sophisticated is often called the very best of the country. The method Mr. Geoffroy took to discover the cheat was this: he procured a long and narrow phial, of an equal diameter all the way up; into this he first put an ounce of fair water, and to this he added an ounce of the oil; he marked the height of the water in the phial, then shook the two liquors together, and they became milky, and heated on the mixture, which alone would have been a sufficient proof that there was spirit of wine in the oil. After some standing the liquor became clear, and the oil floated at the top, but in a much smaller quantity than might have been expected, there being not more than a quarter of an ounce of it, the rest having been spirit of wine, which mixed with the water, and thus left all the true oil, which was only one-fourth of the quantity, to float alone on the water, which was greatly increased in height in the phial. A pint of this oil of spike, therefore, contains only four ounces of the genuine oil, and twelve ounces of plain spirit of wine.

The second method of adulterating this oil, which the same gentleman had suspected, was easily discovered next; for on mixing this quarter of an ounce of pure oil of spike with three quarters of an ounce of oil of turpentine, there was produced an ounce of liquor, which appeared wholly the same with the oil of spike commonly sold in the druggists' shops. And indeed, much of what is usually sold is worse than this, being no other than oil of turpentine scented with a small quantity of true oil of spike.

The ready way of discovering the oil counterfeited with oil of turpentine, is to wet a paper in it, and set it on fire; the turpentine will here be discovered by the thick smoke it yields, it being, of all vegetable oils, that which yields much the thickest cloud in burning; and, on the contrary, that which has been adulterated with spirit of wine, will

be distinguished by the same trial, by its yielding a much finer and thinner smoke, and burning with a bright blue flame. If they be tried by firing them in a spoon, that which is adulterated with spirit of wine will burn very bright, and yield no fume at first; but as it grows near the bottom it will smoke a little, and finally will leave no residuum, except that it varnishes over the inside of the spoon: that adulterated with the oil of turpentine will burn more vehemently, smoke more, and leave a coarser varnish upon the spoon; and if it be of the coarsest kind, that is, if it hath been adulterated with badly rectified oil of turpentine, the fume will be the more abundant, and there will be left in the spoon a fetid matter, resembling melted pitch.

Mr. Geoffroy tried whether, in the business of varnishing, the oil of turpentine alone might not do as well as the oil of spike; he found that it dried perfectly well, but that it left a stinking smell upon the work, which never went off; whereas the mixture of this oil with that of spike, makes a smell like neither, and which soon goes off.

An ounce of oil of turpentine, with only twenty drops, either of our common oil of lavender, or the pure oil of spike, makes a liquor tolerably well scented, and which serves for the purposes of oil of spike. If two drachms of our oil of lavender be added to six drachms of spirit of wine, they immediately mix; and this, afterwards mixed in a small proportion with oil of turpentine, makes a sort of oil of spike.

The most regular method, however, that the artificer can use, if he can get the genuine oil of spike, is to mix one ounce of it with three ounces of oil of turpentine, which perfectly fits it for this purpose, and makes it the same with that in common use. The method of making this perfectly pure, is to redistil it in a *balneum Mariæ*; there will thus be procured an oil highly rectified, and pellucid as water, which will dry away as soon as touched on any thing. The great disadvantage attending the oil of spike adulterated with spirit of wine is, that it will not readily mix with all the sorts of varnish.

Having gone through the properties of oil of spike, in regard to varnish, it remains to inquire into them in regard to its other great use in enamel, and to consider the effects of the two usual methods of adulterating it in this work.

The oil of spike which wants body, is not at all fit for enamelling, because it dries too suddenly, and does not at all assist the natural dryness of the enamel, which is only a sort of powder of glass; and the particles of this powder, with a fluid of too little body, are not manageable by the artists, so that the colour never is brought to a due consistence; and when the oil has too much body, the mixture becomes too tenacious, and is as unmanageable in that extreme as in the other; and this fault is attended with another very great mischief, which is, that the fume raised by this oil, when heated, is often so gross, as to destroy the beauty of the colours. In short, thick oil of turpentine is always destructive of enamels by its smoke.

The true composition for enamelling is oil of spike mixed with spirit of wine, but the proportions must be nicely regulated from repeated trials: for if the quantity of the spirit be too large, it is apt to separate itself from the oil and colour in the drying, and this always spoils the gloss and beauty of the work. Artificers observe, that oil of spike does best for their purposes, after it has been kept two or three years. But this is only owing to the oil's being adulterated with spirit of wine, and usually containing too large a proportion of the spirit when first sent over: it becomes better for use when a part of that spirit has had time to evaporate in the keeping. It would be a better

way for these curious works, to procure the oil pure, and then occasionally mix it with such a proportion of spirit of wine, as experience shews to be the most proper. *Mem. Acad. Par. 1716.*

SPIKE, Lavender. See LAVENDER.

SPIKE, Winged, Grass, in Botany. See STIPA.

SPIKE, Hand, in Mechanics. See HAND-SPIKE.

SPIKE a Gun, in Military Language, &c., signifies to choak up the touch-hole of a piece of ordnance, so as to render it useless. See NAIL.

SPIKE-Roller, in Agriculture, a very useful implement of the roller kind, first introduced by Mr. Randall of York to the notice of the farmer. It has been found of much advantage in bringing stiff cloddy lands into a state of suitable pulverization and fineness of mould for being sown. It is likewise employed, in a beneficial manner, on sward-land that is worn out and mossy, by preparing it for the application of earthy composts and grass-seeds. But it is remarked by the inventor, that in this business the roller must go up and down, till the sward and ground are perfectly well broken up: this being done, the seeds of clover, trefoil, and rye-grass, or any other mixed with them, must be sown in the usual way and quantity; then the compost must be spread over the seeds, so as to cover them; and a common barley-roller, with a thorn-bush fastened to it, must follow, and the ground be shut up, lest the cattle should do harm by treading.

In respect to this sort of roller, the dimensions in length were seven feet, the diameters at the ends eighteen inches, and the whole cylinder made of the heart of oak; and when the irons were burnt in, and the man seated on the box designed for that purpose, the weight of the whole was about a ton. But the blunt ends of the irons were opposed to the clods, and run more taper, till they came to the surface of the cylinder, into which the irons were burnt, and inserted about three inches, which was their length above the surface of the roller, and which he always found very sufficient to crush the hardest clod that ever came in their way. Had he, indeed, attempted to go on the ground, when the soil was not perfectly dry, this position of the irons would have carried the clods round with the roller; for it is not its province to squeeze, but crush. Nor indeed can a man do more harm to his ground than going upon it, when it is not quite dry, with a roller constructed in this way. He had the irons fixed in four inches asunder, in the first row, from end to end. The second row began just between the first and second irons of the first row. The third row was like the first; and the fourth like the second. Then alternately for the whole surface of the cylinder, as near as possible, the irons were four inches asunder in each individual row; and four inches from row to row, as nearly as the superficialities of the cylinder would permit. He does not know how to convey a juster idea of the shape of the irons than to call them ox-harrow teeth, or those of a very large harrow; for when he sent for the workman, he desired him to make so many of this denomination, six inches in length, and burn the small end three inches into the wood. This is a roller that requires a strong team in performing its work.

But in addition to these uses, it has been suggested that it may likewise be very useful in preparing clay for the making of canals, or pieces of water: for where, as sometimes happens, the clay grows dry, and will not admit of being duly tempered for use, without great pains in breaking it, a very large quantity may very soon be reduced to the requisite fineness, by spreading it on hard ground in a due thickness, and passing this roller a few times over it. In extensive works, much trouble and labour may sometimes be

saved by this means, where such a roller is at hand, and the clay prepared in a manner that will answer the purpose much more effectually.

It may also be noticed, that this is a sort of tool which no farm, where the land is a stiff clay, or in the least liable to clot, should want: for besides the constant advantage of saving labour, and bringing land to a better condition for any kind of sowing than the plough and harrow, with any assistance of the work of hands, can make it; in favourable seasons, and under certain circumstances, the loss of the whole crop, by an otherwise unavoidable delay beyond the seed-time, may be with certainty prevented.

It has been stated as an improvement in this implement, in order to prevent its tearing up the ground, and the great stress that is upon the frame in turning, to have it divided into two parts. Let the ends of each part be bound with narrow, but strong, bands of iron, and let the spikes at the ends be placed close to them; let each part have a separate frame; but let the cheeks, in which the inward gudgeons turn, be made of iron plates, about two inches wide above, and four where the gudgeons enter; the thickness, a common flat bar of iron: and these fixed in any firm manner to two cheeks of wood, reaching down just to the bands, and of such a thickness at bottom as not to interrupt the spikes. Let the inward gudgeons be made with quite flat heads, to prevent their slipping out in working, and bring the two ends of the roller nearer together, which is of consequence, as the fewer clots will be milled in working.

Let the frames be joined together by four eyes, like those of a small gate, two at one end, about five or six inches apart; the two at the end of the other, to take place just within them; an iron pin being put through all four, and keyed. Let the thills be placed just on the middle of each frame, and a bar of wood just behind the horse to strengthen them; the bar sawed through in the middle, and joined by a strong flat hinge; one side made to hasp upon a staple, kept down with a wooden clet. This gives the whole proper play in working.

The spikes are about four inches without, and three within the wood: the thickness of the roller and number of spikes may be determined, in some measure, by the nature of the soil it is to work upon. Thus formed, it will be found, it is said, next to the plough, the most useful instrument in tillage, not only in reducing a stiff soil, but, with a bush at its tail, to cover the seed, when sown, much more effectually, and in a better manner, than a harrow, as it turns up the earth light and fine behind it; and, though seemingly unwieldy, will turn with ease, and may be worked with one, two, or three horses at most, upon any land that is of a proper dryness to work upon.

This implement may likewise be employed to assist in reducing the half-burnt turf of burn-baked land, which requires much labour, as commonly done by hand; but by going over the land several times with the spike-roller, and harrowing it with heavy harrows alternately, to pull up the turfs, or ploughing them up, they may be reduced fine in a much shorter time, and at a much less expence, than by beating or breaking them by hand. The mode of constructing the tool, in the common manner, has been already shewn. See ROLLER.

Still more lately, a clod or improved roller of this kind has been constructed by Mr. Blithe Harries of Benthall-house, near Shiffnall, in which the danger of the horses being injured in turning, by the spikes, is obviated. It is found very effectual on strong soils, and well adapted for breaking and reducing clods, pulverizing old turf fallows, and preparing land previous to sowing barley, and many

other purposes. He describes it in the Agricultural Magazine as consisting of twenty-one cast-iron wheels, twenty-one inches and a half in diameter, the edges three inches asunder; or a smaller pattern, consisting of fourteen wheels, twenty-three inches in diameter, the edges four inches and a half asunder, fastened upon an iron axle-tree, with a large wheel at each end to carry it to the field. It is further stated, that the invention is Mr. Gittin's, of the Isle, Shropshire, an ingenious farmer, who had one made at Mr. Onion's foundery, Broseley; and Mr. Harris now makes them at his iron works, the price of which, in either of the patterns, is 10*l.*, exclusive of the row of spikes to clear dirt or stones, and the shafts.

In this state it forms a sort of cutting or bruising implement of the kind, and may be of very great utility in different cases of stiff, cloddy, arable land, as well as in those of the tough, unproductive, overrun sward kind. It is capable of performing a good deal of work, in both these cases, in a short space of time, and in the most effectual manner.

All implements of these kinds having great power and dispatch, are consequently capable of very general application in the business of tillage, as well as grass husbandry. They may be constructed in different cheap methods, and be made use of with much advantage in a variety of situations, where they are at present perhaps wholly, or in a great measure, unknown.

This implement is sometimes called spiky-roller.

SPIKELET, in *Botany*, *Spicula*, is technically used for the assemblage of the florets of grasses, within the calyx; and which consists of two florets only in *Aira* and *Holcus*; of many in *Poa*, *Bromus*, &c.

SPIKENARD, *Bastard French*. See NARDUS.

SPIKENARD, *Celtic*, a species of *Valerian*; which see.

SPIKENARD, *Falſe*. See LAVANDULA.

SPIKENARD, *Ploughman's*. See BACCHARIS.

SPIKENARD, *Ploughman's*, is also the name of a species of flea-bane, or *conyza*; which see.

SPIKENARD, *Nardus*, or *Spica Nardi*, in the *Materia Medica*, a kind of vegetable shoot growing even with the ground, and sometimes, in part, within the ground, belonging to an Indian grassy-leaved plant, of which we have no particular description. The nard, as it is brought to us, is a congeries of small, tough, reddish-brown fibres, forming a bunch, or spike, about the size of a finger.

The *spica nardi* is usually reckoned in the number of roots. It is also called *nardus Indica*; because brought from the East Indies.

It is now kept in the shops chiefly as an ingredient in the mithridate and theriaca, but was formerly employed in the same intention as the Celtic, and is said to be used among the Orientals as a spice. It is moderately warm and pungent, accompanied with a flavour not disagreeable. Lewis.

There is also another kind, called *spica Celtica*, a species of valerian, growing in the Alps, from whence the shops have been generally supplied with the dried roots, consisting of a number of blackish fibres. This root has been recommended as a stomachic, carminative, and diuretic: at present it is scarcely otherwise made use of, in this country, than as an ingredient in mithridate and theriaca, though its sensible qualities promise some considerable medicinal powers. It has a moderately strong smell, of which it is very retentive, and a warm, bitterish, subacid taste, resembling those of common wild valerian. Lewis.

SPIKENARD, *Ointment of*. See NARDINUM Unguentum.

SPIKES, or, as the seamen call them, *specks*, in a *Ship*,
are

are large long iron nails with flat heads. They are of divers lengths, some a foot or two long, and some are jagged, so that they cannot be drawn out again. They are used to fasten the planks and timber. See *MARLING-Spike*.

SPIKING up the Ordnance, a sea-phraze, used for fastening a quoin with spikes to the deck, close to the breech of the carriages of great guns, that they may keep close and firm to the ship's sides, and not get loose when the ship rolls, and by that means endanger the breaking out of the butt-head of a plank. See *QUOIN*.

SPILAMBERTO, in *Geography*, a town of Italy, in the department of the Panaro; 8 miles S.E. of Modena.

SPILANTHUS, in *Botany*, originally called *SPILANTHES* by Jacquin, is derived from *σπίλος*, a spot, and *ανθος*, a flower, because of its dotted or speckled flowers.—Jacq. Amer. 214. Schreb. 543. Willd. Sp. Pl. v. 3. 1712. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 4. 493. Juss. 187. Lamarek Dict. v. 7. 345. Illustr. t. 668. Gært. t. 167.—Class and order, *Syngenesia Polygamia Æqualis*. Nat. Ord. *Compositæ Oppositifoliæ*, Linn. *Corymbiferae*, Juss.

Gen. Ch. *Common calyx* nearly hemispherical, imbricated, with lanceolate, linear, compact scales, in a double row. *Cor.* compound, uniform, tubular, conically convex, the florets numerous, equal, all perfect, funnel-shaped, with a four or five-cleft, reflexed limb. *Stam.* Filaments four or five, capillary, very short; anthers cylindrical, tubular. *Pist.* Germen oblong, compressed; style thread-shaped, the length of the stamens; stigmas two, recurved. *Peric.* none, except the unchanged calyx. *Seeds* solitary, oblong; compressed, flattish. *Down* with a membranous margin, and two unequally-sized awns at the tip. *Recept.* brittle, conical, its scales compressed, deciduous.

Obf. In *S. atriplicifolius* the seeds have no awns; and in *S. Acmella* and *uliginosa* the radius is very small, and composed of only three or five flowers.

Eil. Ch. Receptacle chaffy, conical. Down with two awns, one larger than the other. Calyx nearly equal.

1. *S. urens*. Biting Spilanthus. Willd. n. 1. Jacq. Amer. t. 126. f. 1.—Leaves lanceolate, entire. Stem prostrate.—Native of sandy fields in America, about Carthage, flowering from May to October. *Root* perennial, fibrous. *Stems* herbaceous, round, smooth, procumbent, branched, fibrous at the joints. *Leaves* opposite, sessile, smooth, ribbed. *Flowers* solitary, capitate, terminal, scentless, white, dotted with black.

The leaves of this species possess a hot, pungent flavour, resembling the root of *Pyrethrum*, or Pellitory of Spain, for which they are occasionally substituted.

2. *S. Pseudo-Acmella*. Bastard Acmella or Spear-leaved Spilanthus. Willd. n. 2. (*Verbena Pseudo-Acmella*; Linn. Sp. Pl. 1270. *Chrysanthemum mederaspatanum latifolium, scabiofæ capitulis parvis*; Pluk. Alm. 99. t. 159. f. 4.)—Leaves lanceolate, serrated. Stem erect.—Native of Ceylon, flowering in July. *Root* annual. *Stem* two feet high, round, branched, rather hairy. *Leaves* opposite, stalked, ovate, veined, the stalks channelled and slightly downy. *Flowers* solitary, yellow, on long, upright, naked stalks.

3. *S. Acmella*. Balm-leaved Spilanthus. Willd. n. 3. (*Verbena Acmella*; Linn. Sp. Pl. 1271. *Abcdaria*; Rumph. Amboin. v. 6. 145. t. 65.)—Leaves ovate, serrated. Stem erect. Flowers radiated.—Native of Ceylon, flowering from July to the end of summer. *Stems* about two feet high, much branched. *Leaves* like those of the last species. *Flowers* solitary, radiated, yellow, on very long

stalks. This plant is reputed to be a specific for the stone in the East Indies. It differs chiefly from *Pseudo-Acmella*, in being more branched, and in having radiated flowers.

4. *S. uliginosa*. Boggy Spilanthus. Willd. n. 4. Swartz Prodr. 110. Ind. Occ. 1291.—Leaves ovato-lanceolate, notched. Stem erect, forked. Flowers radiated, terminal, stalked.—Native of the south of Jamaica, in clayey, swampy ground, flowering in the spring. *Root* annual, long, simple, thread-shaped. *Stem* herbaceous, half a foot high, round, smooth, reddish. *Leaves* opposite, stalked, smooth. *Flowers* roundish at first, afterwards conical, yellow.

5. *S. exasperata*. Rough or Warty Spilanthus. Willd. n. 5. Jacq. Ic. Rar. v. 3. t. 584. (*S. radicans*; Jacq. Collect. v. 3. 229.)—Leaves ovate, wavy. Stem forked, ascending, rough with warts at the base. Calyx of five leaves.—Native of Venezuela, and flowering in flowers from July to January. *Root* branched, whitish. *Stem* nearly three feet in height, erect, somewhat hairy, rough towards the base, with sharp, fleshy warts. *Leaves* opposite, stalked, acute, slightly serrated, roughish. *Flowers* solitary, white, on downy stalks. *Seeds* black, fringed with white hairs.

6. *S. alba*. White-flowered Spilanthus. Willd. n. 6. L'Herit. Stirp. Nov. t. 4.—Leaves ovate, wavy; lower ones alternate. Stem branched, ascending. Calyx of many leaves.—Native of Peru. It flowers in June and July. *Root* annual, fibrous, pungent, exciting saliva, whence Murray called this species *salivaria*. *Stem* herbaceous, wavy, upright, rugged, panicled. *Leaves* stalked, spreading, bluntish, hairy, fringed. *Flowers* terminal, solitary, conical, obtuse, white.

7. *S. atriplicifolia*. Orache-leaved Spilanthus. Willd. n. 7. (*Bidens atriplicifolius*; Linn. Sp. Pl. 1168.)—Leaves alternate, deltoid, toothed, stalked, furnished with stipulas. Stem panicled.—Native of South America. *Stem* herbaceous, smooth. *Leaves* alternate, on slender stalks. *Stipulas* equal, kidney-shaped, like little ears. *Flowers* solitary, terminal. *Seeds* without awns, oblong.

8. *S. infipida*. Tasteless or Mild Spilanthus. Willd. n. 8. Jacq. Amer. 215. t. 126. f. 2.—Leaves obovate, toothed, sessile.—Native of America, and found by Jacquin at the Havanna, where it flowers in the winter. *Stems* shrubby, round, branched, procumbent. *Leaves* opposite, nearly sessile, smooth, attenuated at the base. *Flowers* like those of *urens*, and like that species the leaves of this have a salt or biting flavour, but in a milder degree, so that the specific name is not extremely appropriate.

9. *S. oleracea*. Esculent Spilanthus. Willd. n. 9. Jacq. Hort. Vind. v. 2. 63. t. 135.—Leaves ovate, heart-shaped, serrated. Stem branched, diffuse.—Native of the East Indies, flowering at Kew from July to November. *Stems* a foot long, prostrate, round, somewhat rugged. *Leaves* opposite, dark green above, yellowish or glaucous beneath. *Flowers* solitary, terminal, forming a sort of cylinder, yellow. *Seeds* brown, fringed with white hairs.

10. *S. tinctoria*. Dyers' Spilanthus. Mart. Mill. Dict. n. 5. Loureir. Cochinch. 484.—Leaves lanceolate, serrated, smooth. Stem diffuse. Flowers numerous, terminal.—Found on cultivated ground, in China and Cochinchina. *Stem* herbaceous, three feet high, rather procumbent, round. *Leaves* opposite, smooth, rather succulent, bright green. *Flowers* of a blueish-white hue. The leaves when bruised yield a fine blue colour, whence it is cultivated by the natives for dyeing. This is very closely allied to *S. Acmella*.

SPILBACH, in *Geography*, a town of Bavaria, in the territory of Rothenburg; 4 miles W.N.W. of Rothenburg.

SPILE, in *Ship-Building*, a plug made of fir to fill up holes, where nails have been driven, to prevent leaking, &c.

SPILE, in *Rural Economy*, a piece of wood sharpened at the point, and drove down into the ground, on the sides of rivers, or other places, for the purpose of protecting their banks, or other parts, against the destructive violence of the waters. They should be well proportioned for the purpose, and be very firmly driven down by proper machinery.

But in whatever way, or however firmly, spiles may be driven down into the ground, they never form a good or secure defence against the force of river-currents. The only method of completely effecting this is now well understood to be that of making the banks to shelve, or slope well backward from the rivers, and throwing the force of such streams in new, contrary, or other directions than those to which they have been accustomed. In these ways much is not unfrequently accomplished, without any great deal of labour, trouble, or expence in any manner.

SPILE is also a term provincially used to signify the vent-peg of a cask.

SPILEMBERGO, in *Geography*, a town of Italy, in Friuli, on the Tajamento; 14 miles W. of Udina.

SPIILINGS, in *Ship-Building*, the dimensions taken from a rule-staff, a mould's edge, or straight line, to trim or fay one piece to another.

SPIILKEVY, in *Geography*, a town of Norway, in the province of Drontheim; 88 miles S.W. of Romsdal.

SPIILL, *To*, in *Sea-Language*, is to discharge the wind out of the cavity or belly of a sail, when it is drawn up in the brails, in order to furl or reef it. This is performed either by collecting the sail together, or by bracing its edge to the wind, so as to shiver or be laid aback. Falconer.

SPIILLING-LINES, in a *Ship*, certain ropes fixed occasionally to the main-sail, and fore-sail, in tempestuous weather, for raising or furling them more conveniently. They are passed through blocks above the yard, and thence leading down before the sail, come under its bottom, and return upwards behind it to the yard, where they are fastened; so that the sail by this effort is closely and immovably confined to the yard. Falconer.

SPILOMA, in *Botany*, so called by Acharius, from *σπίλωμα*, a stain, or spot, in allusion to the appearance of the fructification.—Ach. Meth. 9. Lichenogr. 23. t. 1. f. 1. Syn. 1. Sm. Engl. Bot. v. 29. 2075.—Class and order, *Cryptogamia Algæ*. Nat. Ord. *Algæ, Lichenes*.

Ess. Ch. Receptacles shapeless, without a border, hairy and powdery, in an uninterrupted crust.

This minute and obscure genus of the Lichen tribe has long been overlooked, or confounded with other things. The species, which are sixteen in Acharius's recently published *Synopsis*, are found either on old wood, the bark of trees, or on rocks and walls. Thirteen are figured and described in Engl. Bot. v. 29—36. Some of these, as *S. Vitiligo*, t. 2075, looks to the naked eye like a little grey dull, scattered over the pales on which it grows, and staining the finger when touched. Others resemble crustaceous Lichens, particularly *Lecidææ*; but are distinguished by their black powder, which comes off with a touch; as *S. versicolor*, t. 2076, and *variolosum*, t. 2077, both found on old trees. *S. auratum*, t. 2078, is still more remarkable for the internal orange-colour of its receptacles, which becomes visible whenever they are rubbed or broken.

SPIILSBY, in *Geography*, a market-town in the east division of the foke of Bolingbroke, parts of Lindsey, in the county of Lincoln, England, is situated on an eminence, overlooking to the south a large tract of marsh and fen land, which is bounded by Boston Deepes and the German ocean.

Spilsby is the chief town in the southern part of Lindsey division, and is 31 miles E. from Lincoln, and 134 miles N. from London. It consists principally of four streets, uniting at the market-place, which forms a spacious square, intersected in the centre by a row of houses, with the market-cross at the east end, and the town-hall at the west. The market-cross consists of a plain octagonal shaft, with a quadrangular base; the whole elevated on five steps. The town-hall, a plain brick building, standing on arches, was built in 1764, on the site of the old hall, which, being in a ruinous state, had been taken down. The general quarter-sessions of the peace, for the southern division of the parts of Lindsey, have been holden here for upwards of a hundred years. The parish-church, situated on the west side of the town, is an irregular building, consisting of north and south aisles, the latter of much larger extent than the rest of the edifice. A chapel occupies the extremity of the body of the church, in which are some ancient monuments, belonging to the families of Beke, Willoughby, and Bertie. At the west end of the church is an embattled tower, of a more modern date than the other parts of the structure, and probably erected about the time of Henry VII. Here is a small free-school, supported by the rents of certain tenements bequeathed for that purpose; and a Sunday school, recently established, promises to be of great advantage to the lower classes of the people. A weekly market is held on Mondays, and three fairs annually. The population return of the year 1811 states the number of houses to be 230, occupied by 963 persons.

At Erefby, two miles from Spilsby, was formerly a mansion, noticed by Leland, belonging to the Bekes and to the Willoughbys. It was taken down, and another built on the site, which was destroyed by fire: a stately avenue of trees leads to the site. The place is now abandoned for the more splendid domain of Grimthorpe. Erefby was a grant from William the Conqueror to Walter Beke. It was possessed successively by the Bekes, Willoughbys, and Berties, till the year 1778, when, with the manor of Spilsby, it became the property of sir Peter Burrell, now lord Gwydir, by his marriage with lady Willoughby, daughter and coheirefs of the duke of Ancaster. Beauties of England and Wales, vol. ix. Lincolnshire, by J. Britton, F.S.A.

SPIN HAY, *To*, in *Military Language*, is to twist it up in very hard ropes, for an expedition: so that it may be the less bulky for the cavalry to carry behind them.

SPINA, in *Botany and Vegetable Physiology*, a thorn originating from the substance of the wood itself. (See **FULCRA**.) Linnæus remarks that a thorn is liable to disappear by culture, or richness of soil, as in the pear-tree. Hence he speaks of such plants as becoming tame by the influence of good treatment; whereas prickles, *aculei*, seated in the bark, are not affected by similar causes. The reason is well explained by Willdenow, who justly considers thorns as of the nature of abortive branches, stunted in their growth for want of nourishment.

SPINA, in *Geography*, a town of France, in the department of the Tanaro; 9 miles S.W. of Acqui.

SPINA Bifida, *Cloven Spine*, in *Surgery*, frequently named also *Hydrorachitis*, is a tumour for the most part situated on the spines of young children, commonly on the lumbar vertebra; occasionally on the dorsal or cervical ones; and sometimes, though less frequently, on the os sacrum.

A tumour of a similar nature is now and then observed upon the head. Richter's Chirurg. Bibliothek, 9 band, p. 186.

In cases of spina bifida, the swelling is soft, and may be gradually

gradually diminished, or even made to disappear entirely by pressure; but it always returns again immediately when the pressure is removed. The fluctuation of a fluid is distinctly perceptible to the touch. The integuments retain their natural colour and appearance. However, the children seem to experience pain when the tumour is compressed, or when they are placed upon their backs. The size of the swelling is extremely various, it does not often exceed that of an orange; but, in a few instances, it is much more considerable.

The generality of children affected with spina bifida are deficient in strength and vigour, and are subject to frequent diarrhoea. Some cannot retain their urine and feces. A weakness and emaciation are often particularly observable in the lower extremities, which, indeed, are sometimes almost paralytic. Though most children agree with this account, it deserves notice, that many others are, in every respect except the tumour, perfectly healthy and well formed.

When a spina bifida is dissected, the swelling is found to consist of a sac, filled with an aqueous fluid, and composed of the integuments, and of the membranous sheath which lines the canal of the spinal marrow. The lining of the spinal canal protrudes through a fissure in the vertebræ. This fissure is owing to an imperfect formation of these bones, and is commonly found at their posterior part, where the spinous processes would otherwise be. The preternatural opening is sometimes confined to one bone, and then the swelling frequently has a small base. In many instances, the ossification of several of the vertebræ is not completed behind, so that the canal for the spinal marrow resembles an open furrow. Even the whole spine, from one end to the other, has been found thus imperfect. (Maret, Mem. de Dijon, vol. ii. p. 105.) The aperture has been known to extend through the body of the affected vertebra, so that the finger could be passed quite through into the abdomen. (Saltzmann, De Tumouribus quibusdam Serosis externis.) In one example, there was not only a furrow in the vertebræ, all the processes of these bones were wanting. Richter's Chir. Bibliothek, 4 b. 2 ft. p. 350.

In general, the sac is filled with a clear, transparent fluid; but occasionally, the contents are turbid, yellowish, and bloody. The portion of the spinal marrow surrounded by the fluid is generally softened, and almost like mucus, or thin matter. Mem. de l'Acad. de Dijon, vol. ii.; and Richter's Anfangsgr. der Wundarzneykunst, band 2. p. 236, Dritte Auflage.

Children afflicted with this disease sometimes suffer at the same time from hydrocephalus. They seldom live longer than a year after birth. The tumour generally continues to enlarge. Occasionally it inflames and ulcerates, and then death very soon follows. Children are observed to live longest when the swelling is remote from the head. The instances of persons attaining a middle age with this disorder are rare, and these subjects have mostly had their lower extremities in a paralytic useless state. Examples, however, are recorded, in which patients labouring under this affliction, have lived to the ages of eight, seventeen, twenty, and fifty. Acrell K. Vetenskaps, Ac. Haedligar, 1748, p. 91. Warner's Cases in Surgery, p. 136, ed. 4. Hochstaetter, Diff. de Spina Bifida, Altorf, 1703.

Experience has proved, that puncturing the tumour with a lancet, and thus discharging the fluid, either at once or gradually, cannot be practised without inducing fatal consequences. Also, when the swelling ulcerates and bursts of itself, the child perishes; nor has tying the pedicles of such spina bifida as have narrow bases proved more successful. Some years ago, Mr. Abernethy suggested the method of letting out the fluid, healing the puncture directly after-

wards, and repeating the same proceedings as often as necessary. (See Abernethy's Surgical and Physiological Essays, parts i. and iii.) This gentleman tried the plan in one instance, and though it was not attended with ultimate success, it did not seem to bring on the sudden fatal symptoms, which are the usual effects of letting out the fluid in the common way.

This last proposal, which originated with Mr. Abernethy, is important, inasmuch as recent observations have proved, that a practice founded on the foregoing principles may actually effect a cure of a disease that, until very lately, always baffled the art of surgery. It is to Mr. A. Cooper that we are indebted for the mode of puncturing spina bifida with a fine needle, thus letting out the fluid from time to time, and promoting a closure of the opening in the spine, by applying a compress and bandage. The adhesive inflammation, in fact, obliterates the cavity in which the fluid collects, and the disease ultimately does not return. In one case, Mr. A. Cooper seems to have accomplished in this manner a perfect cure. See Medico-Chirurgical Transf. vol. ii. case 2, p. 326.

This eminent surgeon, however, pursues two modes of treatment for the relief of children afflicted with spina bifida; one palliative, the other radical.

The first consists in treating the case as a hernia, and applying a truss to prevent its descent; the second, in pricking the tumour with a fine needle, and in producing an adhesion of the sides of the sac, so as to close the opening in the spine, and stop the disease altogether. The first is attended with no risk; the second exposes the patient to much constitutional irritation; but, if successful, hinders the future recurrence of the disease. Even when the adhesive process cannot be effectually accomplished by the second plan, the palliative method may yet be tried. See case 4, lib. supra cit.

Unfortunately, there are numerous cases of spina bifida which leave no hope of cure. The following examples of this description are pointed out by Mr. A. Cooper.

If the tumour is connected with an unnatural enlargement of the head, hydrocephalus internus is conjoined with spina bifida, and the water will accumulate in the ventricles of the brain, whether the radical or palliative treatment of the tumour on the back be tried.

If the lower extremities are paralytic, or the feces and urine are discharged involuntarily, there is no hope of relief.

If the tumour has burst at the time of birth, or soon afterwards, little expectation of a cure can be indulged; for although the opening in the skin may be closed with lint and adhesive plaster, and union be produced, so that no more of the fluid can escape, yet hydrocephalus internus will follow.

The deficiency of the spine is sometimes so great, that the tumour, at the time of the child's birth, is very considerable; the nerves are protruded out of the spinal canal; the spinal marrow is injured; and all attempts at a cure must be unavailing. Medico-Chirurgical Transf. vol. ii.

In this disease, purgatives and diuretics have been tried in vain; and no outward applications, excepting pressure, have been found to do the least good. Richter has suggested making two issues near the tumour; but the proposal hardly frings with it a promise of utility. In short, in the present state of our knowledge, the practice tried by Mr. A. Cooper is the only one in favour of which facts and actual experience can be adduced; and, if we except the cases published by this gentleman, we have no instance on record of a spina bifida being cured or benefited.

When

When the disease does not admit of the radical or palliative cure, the surgeon should instruct the friends of the patient to keep the tumour out of the way of every thing that has a tendency to make it inflame and ulcerate; and, if any thing at all is done, the swelling should be tenderly bathed every now and then with spirituous and mildly astringent lotions, with a view of averting inflammation and ulceration of the skin. First Lines of the Practice of Surgery, by S. Cooper, edit. 3.

SPINA Burgi, in *Botany*, a name used by some authors for the *alaternus*, or ever-green privet, a garden shrub, the fruit of which is a mild astringent.

SPINA Ventosa, in *Surgery*, a caries or abscess of the internal part of a bone. *Spina* was a term applied by the Arabian writers, because the disease occasioned a pricking in the flesh; and the epithet *ventosa* was added, because the part affected communicates a feel as if it contained air. *Spina ventosa* is often employed synonymously with white-swelling. See WHITE-SWELLING.

SPINACH, or *SPINAGE*, in *Botany*. See *SPINACIA*.

Spinach is sometimes cultivated in the field for the advantage of the seed. The different sorts of it are raised in this manner, in order to supply the demand for the different kinds of feed.

The land for these crops is finely prepared by different ploughings and harrowings in the early spring, and a little well rotted dung intimately blended with the soil, where the land is not of a good quality.

The different sorts of seed are then sown in small furrows made for the purpose, in the ground, either by the hand-hoe, or by means of a drill for this use, at the distance of from about twelve to fourteen inches from each other; the prickly sort of seed being used in the proportion of six gallons to the acre, and the round sort in that of four to the same quantity of land.

Some time in the early part of March, when the plants have advanced so as to have leaves of about one or two inches in length, they are thinned out by the hoe to the distance of four or five inches. The rows of plants are always kept well moulded up both before and after the period of thinning, and the whole crop preserved in a perfectly clean state from weeds. As soon as the crop has reached the time of being in full bloom, the greater part of the male plants are drawn out, by the hand, from among the others, by which means the female plants are allowed more room, light, and air to grow in, and thereby to perfect their seed in a better and more full manner. The plants which are thus drawn out answer in a very profitable manner in the feeding of young pigs, and they may probably be given to some other sorts of animals with advantage.

When the crop becomes quite ripe, it is pulled up, and the seed either threshed out on a cloth in the field, or the whole carried to the barn, to be afterwards threshed out. See *SPINACIA*.

The produce is usually from about two to five quarters on the acre, according as the season and other circumstances are less or more favourable.

The cultivation of spinach for seed in the field often turns out very advantageously, but it is attended with some degree of uncertainty, as is the case with most crops of this nature.

It is a crop which is much grown in the Isle of Thanet, and in East Kent, in order to supply seed for the London seedsmen.

SPINACH, *Strawberry*. See *BLITUM*.

SPINACH, *Wild*, in *Agriculture*, the name of a weed, as

the goose-foot. It is very troublesome in some sorts of land.

SPINACHIA, in *Icthyology*, a name given by some authors to our common stickleback, or banstickle, more usually known among writers by the names *pungitius*, or *aculeatus pisciculus*. See *STICKLE-Back*.

SPINACIA, in *Botany*, a name of dubious origin, but the most general and probable etymology deduces it from *spina*, a thorn, on account of the prickly or spinous integument of the fruit.—Linn. Gen. 520. Schreb. 688. Willd. Sp. Pl. v. 4. 766. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 5. 385. Tournef. t. 308. Juss. 85. Lamarck Illustr. t. 815. Gærtn. t. 126.—Class and order, *Dioecia Pentandria*. Nat. Ord. *Holeraceae*, Linn. *Atriplices*, Juss.

Gen. Ch. Male, *Cal.* Perianth inferior, deeply cloven into five concave, oblong, obtuse segments. *Cor.* none. *Stam.* Filaments five, capillary, longer than the calyx; anthers oblong, twin.

Female, *Cal.* Perianth inferior, of one leaf, permanent, cloven into four, alternately smaller segments. *Cor.* none. *Pist.* Germen inferior, roundish, compressed; styles four, capillary; stigmas simple. *Peric.* none, except the surrounding, hardened calyx, which encloses a solitary, roundish seed.

Obf. The fruit is occasionally round, but generally beset with two or four horns or spines.

Eff. Ch. Male, Calyx deeply five-cleft. Corolla none.

Female, Calyx four-cleft. Corolla none. Styles four. Seed solitary, within the hardened calyx.

1. *S. oleracea*. Garden Spinach. Linn. Sp. Pl. 1456. "Schkuhr. Handb. v. 3. 469. t. 324." (*Spinachia*; Ger. Em. 330.)—Fruit sessile.—Native place of growth unknown. It was cultivated in Great Britain so long back as the year 1568, and flowers throughout the summer. *Root* annual. *Stem* one or two feet high, herbaceous, branched, hollow. *Leaves* arrow-shaped. *Male flowers* herbaceous, in long spikes, abounding with pollen. *Female flowers* on a separate plant, in clusters on the stalks at every joint, herbaceous, small. *Seeds* roundish, unarmed, subject to vary with regard to spines.

There are two or three varieties of the garden spinach, one called *prickly*, another *smooth*; differing in the size and shape of the leaves, and in their seeds being more or less prickly.

This plant does not appear to have been known to the ancients. It is called *Hispnac* by Arabian physicians, and has been so long and generally cultivated in Spain, as to have obtained the name of *Hispnanumolus*. A conjecture is proposed by professor Martyn respecting the introduction of this plant into Spain by the Saracens.

2. *S. fera*. Wild Spinach. Linn. Sp. Pl. 1456. (*S. foliis ex deltoideo-ovatis, subsinuatis, capsulis in orbem dispositis*; Gmel. Sib. v. 3. 86. t. 16.)—Fruit stalked.—Native of Siberia, in damp, unfrequented places.—*Root* annual, whitish. *Stem* nearly two feet high, branched, erect. *Leaves* stalked, triangular or ovate, occasionally sinuated, obtuse. *Male flowers* in close heads, near the females, or in solitary, interrupted spikes. *Fruits* axillary, three or more, on stalks of their own length, ovate or obovate, obtuse, slightly keeled on each side, smooth, very obtuse.

SPINACIA, in *Gardening*, contains a plant of the annual culinary kind, of which the species cultivated is the garden spinach (*S. oleracea*.)

There are varieties of this which differ in the size and shape of the leaves, and the greater or less prickliness of the seeds; as the triangular with prickly seeds, in which the

SPINACIA.

leaves are triangular and sharp arrow-pointed, the seeds somewhat armed with short spines; the round with smooth seeds, which has ovate thick leaves, not angular at their base; both the stalks and leaves are much more fleshy and succulent than in the other sort; and the seeds are smooth, without any spines. Of this also there are two or three sub-varieties, differing in the shape, thickness, and size of their leaves.

In each of the principal sorts there are variations in the leaves, as to their form and magnitude, but the broadest and thickest-leaved sorts are far the best in quality. Those with the most thick and stocky leaves, of a strong dark green colour and luxuriant growth, are commonly supposed the most valuable sort of the round kind.

Method of general Culture.—In these plants it is effected only by seed, by sowing it every year in spring and autumn; the former furnishing the main spring and summer crops; and the latter the winter, and those for early spring use. The prickly sort is the best for winter crops, and the round for the summer ones.

The seed should be sown at several intervals of time from January till August, as every month, three weeks, or fortnight, according to the earliness or advanced period of the season, so as to obtain a regular succession most part of the year. The general spring crop should be sown in March, and the general winter crop about the beginning of August.

But in the spring sowings, as the crops in the very early sowings in January run soon to seed, a moderate quantity should only be sown. However, in the autumn sowings, as the plants do not run the same year, good full crops, to stand for winter and early spring use, may be put in.

These plants succeed in any common soil of the kitchen-garden; but the richer in dung the better; always choosing an open situation, not too near low spreading trees, &c. as they never succeed in close or shady places, in which they are always drawn up weak, and soon run to seed without attaining perfection: a warm border may be proper for the early crops; but for the main crops in general, the open quarters are the most suitable, though a broad warm-lying border may also be proper for some part of the later sown winter crops occasionally, for the purpose of having the advantage of a little shelter of the fence, and benefit of the sun during the winter season; and fresh seed should be procured for each sowing, as this will be found of great importance in the free growth of the plants: for the autumn sowings of the winter crops, it is of advantage to procure new seed of the same year.

And after the ground has been properly dug, the seed may either be sown broad-cast, and raked in, or in shallow drills a foot asunder; though broad-cast is the most expeditious, and probably the most proper method for the growth of the crops in the product of large full leaves; sowing it all over the surface moderately thin, either in one continued plat, and trodden down evenly, if light ground, and raked in with a large rake or light harrow; or the ground may be divided into four or five-foot wide beds, with foot-wide alleys between each, especially for the early and winter crops in moist ground; the seeds being sown as above, raking them in evenly: drill-sowing may also be occasionally practised with convenience and advantage, in which the drawing of the drills should be performed with a hoe flatways, near an inch deep, and ten or twelve inches asunder, then scattering the seeds thinly along them, raking the earth over full half an inch deep; which mode is often very proper in sowing between other crops, as between wide rows of beans, peas,

cabbages, &c. as it admits of hoeing up the weeds between the rows with facility; and if sown thin, and the plants be thinned out properly, they grow large and fine, and the produce is very conveniently gathered. It may likewise be sown in wide drills alone, about a foot distance, for a distinct full crop: or in rows two feet asunder, to admit of intercropping in the intervals, with rows of cabbages, beans, and other things occasionally. In these sowings the seeds should be scattered moderately thin, and the plants be afterwards thinned out to three inches distance at least, the seeds being directly raked regularly in: and when sown broad-cast all over the surface, if in light loose land, and a dry warm season in the advanced part of spring, or in the summer and autumn, it may be proper first to tread the seed evenly down, then raking it in effectually with a large rake. The seeds mostly come up in a fortnight; or perhaps, if sown very early in spring, it may be three weeks or a month before they appear.

In respect to the after-culture of the crops, when the plants have three or four leaves an inch broad, they should be thinned out and cleared from weeds, either by hoe or hand; but the former is the most eligible, especially for the broad-cast sown crops; choosing dry weather, and cutting out the plants to three or four inches distance, together with all the weeds in every part; but the above distance is scarcely sufficient, unless it is intended to begin thinning out the plants for use while young: in other cases it is advisable to hoe them out six or eight inches asunder, especially the spring and summer crops of the round spinach, which, having proper room, will grow very large, and spread its broad leaves widely, and does not run to seed so soon as if left close. When the spring and summer-sown crops are left too close, they are apt to draw up weak, and soon go to seed. The winter crops of triangular or prickly spinach, it will be sufficient in most cases to thin out finally to three or four inches distance.

These crops are often sown in spring with other crops, for the sake of cropping the ground to the best advantage; but it is best when performed alone in most instances.

They may, however, in some cases, be put in between the rows of particular plants with some utility in the way of saving ground, where that is material, as between young cabbage and cauliflower plants, which have been finally set out at wide distances for main crops, as well as in the large intervals of pea and bean crops, especially when of the low or dwarf kind, and between some other sorts of general rowed crops with wide spaces. The spinach seed, in these circumstances, is mostly best put into the ground in single or double drills in the middle parts, according to the distances of the rows of the other plants; but it is sometimes sown in the broad-cast manner over the whole surfaces of the intervals, and raked in. And it is occasionally sown over all the piece of ground in mixture with short-top radish seed, and raked in; after which, either immediately or in a short suitable space of time, the plants or other crops are planted out or sown in their regular modes. The sowing of spinach seed in this way, commonly takes place in the early parts of February and the following month, and is practised upon the borders, as well as the large quarters where such main spring crops are to be grown and cultivated. The plants or other crops in this mode growing quickly, have soon the advantage of the mixed crops between their rows, though the small plants of these kinds are not injured or retarded in their growth thereby, as they are ready to be gathered and removed for use long before the main crops have any hurtful tendency.

Immediately

SPINACIA.

Immediately on the removal of such small crops, the intervals of the rows are hoed over to loosen the earth, which is then drawn up to the stems of the plants or other crops. These methods of cropping are, however, only to be used in such cases as the above.

When the plants have leaves two or three inches broad, they may be gathered. The method of which is, either by cutting them up with a knife wholly to the bottom, or drawing and cleaning them out by the root, if the crops want thinning; or only cropping the large outer leaves, the root and heart remaining to shoot out again. With the spring crops, when the plants want thinning, they may be cut up wholly to the root, thinning them out where thickest in a gradual manner, so as to leave the standing plants at least six or eight inches distant to grow to perfection, which, when beginning to shoot for seed, may also be cut up wholly to the bottom: and in the winter crops, if the plants stand too close at first, some may be thinned out quite to the bottom, afterwards the larger outer leaves only must be cropped in the winter and early part of the spring; but when the spring is more advanced, and the plants grown large and require thinning, or when they begin to run to seed, cutting them up to the bottom in a thinning order is the best method.

Some of the best of the different sorts of plants should be left in the spring to stand for seed, which should be collected, when well ripened, in the manner directed below.

Culture in the early and succession Crops.—In raising early crops of this sort, as well as those which are to come in regular succession, during the beginning of the spring and the first part of the summer season, it will be necessary to commence and continue the sowing of the seed at two or three different times in the month of January, when the weather is mild and open, choosing the most dry and warm situations that can be found for the purpose, and only putting in small quantities in each of such sowings, as the crops are extremely liable to be destroyed or to run to seed. In the succeeding month it will likewise be proper to continue the sowings in a more full manner as to the quantities, at two or three additional different periods, in almost any open places of the garden, by which means full successions may be provided, for some length of time, to follow the crops of the first winter sowings, which will now soon run up to seed, these sowings coming in much about the same time. In the two months which follow the last, it will still be proper to proceed or go on with the sowing of this sort of seed every ten days, or fortnight, making use of open but rather cooler situations. By this means regular supplies will be provided for the concluding spring and beginning summer months.

And in cases where constant successions of crops of this kind are wanted the whole of the summer season, it will be requisite and proper to continue the repetition of the sowings every fortnight during the months of May, June, and July, as the plants in these sowings very quickly run up for seed. The most moist spots which the garden affords should now be selected for such crops, they being free and open. It is also advantageous in the summer sowings to have showery weather for performing the work in, when it can be had. The seed should be sown rather thin, when in the broad-cast method; and in the drill mode to only the depth of about an inch. The plants are to be kept pretty well thinned, in order to prevent their drawing up to seed. The sowings which are made in the last of these months, will continue the crops in succession, until they are succeeded by those of the winter sowings.

In these cases the spinach is sometimes not suffered to

grow large, but cut in its young growth, allowing the bottom parts to grow again.

In the after-culture there is nothing material in these crops, besides that which is necessary in the general ones.

Culture in the late or winter Crops.—In these cases the seed is sown to the most advantage for the succeeding crops towards the end of the first week in August, the beginning of the second, and the middle of the third, according to the nature, situation, and state of the ground, as they are the most prevented in common from running up too early to seed, while they get a little growth, and become somewhat forwarded and strong before the winter weather sets in. It is best when the sowings can be performed in rather moist showery times, as when it is done at dry hot periods, the seed is apt to sprout and come up in an irregular manner, the plants appearing in a straggling sparing state. These crops should constantly have, as much as possible, open situations, which lie dry at this season of the year, and which have funny exposures.

The seed is to be immediately sown on the fresh newly turned up soil, either over the whole surface, or in the bed manner, which is more convenient for the cultivation and collecting of the produce. In some places, a slight sprinkling of the brown Dutch and common cabbage lettuce seed, or other similar sorts, are sown along with this kind of seed in these crops, in order to stand for culling out during the winter and early spring months. The seed is to be covered and trod in directly after being sown.

These late crops are also occasionally, though rarely, sown in the drill manner, but the former methods are more suitable in these cases, where gradual thinning is to be practised with the crops, which is by much the best sort of cultivation for having such crops in fine perfection.

Where large crops of the winter kind are raised, as in market gardens, early cabbages are sometimes planted out with these crops in wide rows, as three or four feet apart. The setting out of these plants takes place in October or the following month. At these distances no injury is done to the spinach crops by the growth of the cabbage plants, and in the early spring, the spinach being wholly cleared away for use, a full forward cabbage crop is left, and the most is made of the land and time.

The plants in these late crops want thinning and clearing from weeds early in their growth, as when less than an inch in the breadth of the leaves, which may be done by the use of the hoe in a dry time, leaving the plants not more than three or four inches apart, as some may be gradually afterwards thinned out for use, so as to let them ultimately stand about five inches from each other; the leaves are after this only to be gathered for use, during the whole winter season, the larger outer ones being alone taken, the smaller inner ones being always left to expand themselves by degrees, in their turn, and afford regular successional supplies until the end of the spring, at which time, when the plants begin to grow large and crowd each other, or to shoot up for seed, they may be wholly cleared away.

In these crops much attention is necessary to keep them clear from weeds, by frequent hoeing and hand-weeding, being careful to remove chick-weed, which is always liable to infect these crops much in winter. All the large weeds should be wholly removed from the ground, as if left they do great injury, and not unfrequently take root again.

As the spring advances, the surface of the ground should be lightly hoed among and about the plants, taking a fine mild dry day for the purpose; which will greatly promote the growth of them, and by which they will soon shoot out strongly, becoming further in a fine state of perfection

for use. The large outer leaves are still only to be gathered, except where the plants stand too thick in the crops.

Saving Seed.—The seed being perfectly ripe in the plants which are left for this purpose, which should always be those of the most stocky growth, and which have the largest, the most expanded, and the thickest leaves, is easily known by its turning of a brown colour, and hardening in the tops of the seed-stalks. The plants of the winter crops mostly run up first to form seed-stalks, being soon, however, followed by those of the spring-sowings, and they are commonly loaded with plenty of well-ripened fertile seeds about the close of July or beginning of the following month. In this state the stalks are to be pulled up and spread out to dry for a few days, turning them as it may be necessary, in order to fully dry and harden the whole of the seed in a proper manner. They are then to be beat or threshed out from the seed-stalks upon a cloth, and put up in bags to be kept in a dry situation for use.

The seed which is newly saved is excellent for sowing the winter crops with, provided it be ripe in due time. It will, however, remain perfectly good until the following year's sowing, but should not be trusted to when more than one year old, as new seed is always of material importance in this culture.

It is proper and necessary, in raising the seed of the different varieties, to have the plants of the different sorts, in different situations, at some considerable distance from each other, in order to prevent injury and degeneracy, by the farina of one sort being dispersed over the other.

The plants of the different kinds are readily distinguishable when they are in flower, and the male plants, after they have dispersed their farina, are in some districts, where the providing of this sort of seed is an object, drawn out, so as to leave more room for the feed-plants. See SPINACH.

SPINADESCO, in *Geography*, a town of Italy, in the department of the Upper Po; 4 miles W. of Cremona.

SPINÆ, in *Ancient Geography*, a station in the 13th and 14th Iter of Antonine's Itinerary of Britain, between Durocornovium or Cirencester and Calleva or Silchester in the former, and Cunellio or Marlborough and Calleva in the latter, and corresponding to Speen, near Newbury, (which see.) The number of miles between Cirencester and Speen being only 15, which gives too small a distance, Dr. Stukeley supposes that a station is omitted between these two places; but Mr. Horsley conjectures, that the numerals opposite to Spinis should have been 35.

SPINAL ARTERIES, in *Anatomy*, are two arteries, one anterior and one posterior, both produced by the vertebrales; each of which, as soon as it enters the cranium, sends out a small branch, by the union of which the posterior spinalis is formed. Afterwards the vertebrales advancing on the apophysis basilaris, or production of the occipital bone, detach backward two other small branches, which likewise meet, and by their union form the spinalis anterior. These spinal arteries run down on the fore and back sides of the medulla spinalis, and by small transverse ramifications, communicate with those which the intercostal and lumbar arteries send to the same part. See ARTERY, BRAIN, and SPINE.

SPINAL Marrow. See MEDULLA Spinalis, MEDULLARY System, and BRAIN.

SPINAL Muscles, are those vertebral muscles which are wholly fixed in the spinal apophysis. See MUSCLE and SPINE.

SPINAL Nerves. See NERVE and SPINE.

SPINAL Apparatus, a machine for affording support to

the spine, and imagined by certain practitioners to be useful in cases of disease and distortion of the vertebræ.

SPINALIS, in *Anatomy*, a muscle on the side of the neck, arising from the five superior processes of the vertebræ of the thorax, and the inferior of the neck; and which in its ascent, becoming more fleshy, is inserted into the inferior part of the vertebræ of the neck laterally. It serves to draw the neck backwards. See SPINE.

SPINALIS cervicis, a name given by Albinus to a muscle of the neck, called by Fallopius the *tertium par musculorum dorfi*, and by Cowper and Morgagni, *spinalis colli*.

This is the muscle, which the French anatomists call *les vertebraux externes du demi-épineux, ou le transversaire épineux dorsal*.

SPINALES colli minores, muscles lying between the six spinal apophyses of the neck, and between the last of the neck and first of the back; being inserted in these apophyses by both extremities on one side of the posterior cervical ligament, which parts them from those of the other side. They are likewise termed *interspinales*.

SPINALIS dorfi, a name given by Albinus to a muscle of the back, figured by Eustachius, *Tab. 37*, and called by Fallopius *quinti paris dorfi musculorum pars implantata in spinas vertebrarum thoracis*.

Others, as Spigelius, have called it a part of the semi-spinatus, and others a part of the longissimus dorfi. The French have named it *le grand épineux de dos*.

SPINALIS dorfi major, a pretty long and slender muscle, lying upon the lateral part of the extremities of the spinal apophyses of the back. It is composed of several muscular fasciculi of different lengths, which crossing each other, are inserted laterally by small tendons in the spinal apophyses from the second, third, or fourth vertebræ of the back; and sometimes, though seldom, from the last of the neck, or first of the back, all the way to the first or second vertebræ of the loins, with several irregular decussations, which vary in different subjects. The longest fasciculi are all a little incurvated, and the whole muscle terminates in points at its ends, but is considerably broad in the middle. It communicates by some fibres with the longissimus dorfi and semi-spinalis, and sends off fasciculi to several transverse apophyses of the back, from the fourth to the eleventh. It is called by some semi-spinalis, but very improperly. See MUSCLE and SPINE.

SPINALIS, *femii, colli, and dorfi*. See SEMI-SPINALIS.

SPINALES dorfi minores. These muscles are of two kinds; some go laterally from the extremity of one spinal apophysis to another, being often mixed with the short fasciculi of the spinalis major; the rest lie directly between the extremities of two neighbouring spinal apophyses, being separated from those on the other side by the spinal ligament. These are smaller and thinner than those of the neck, and are properly enough termed *interspinales*. See MUSCLE and SPINE.

SPINALES et transversales lumborum. There are some fasciculi which run up from the superior false spines of the os sacrum to the lower spinal apophyses of the loins, which may be looked upon as so many *spinales lumborum majores*; and there are also some *spinales lumborum minores* between the spinal apophyses of the loins, and *transversales minores* between the transverse apophyses, which are sometimes of a considerable breadth. See SPINE.

SPINALIS Medulla. See MEDULLA, &c.

SPINA-LONGA, in *Geography*, a sea-port town and citadel, situated near a cape of the same name, on the island of Candia, with a good harbour, formerly the see of a bishop; 30 miles E. of Candia. The harbour is formed by a peninsula,

fula, which secures it from the easterly winds. Its entrance faces the N.N.E., but it is sheltered and protected by an islet, on which the Venetians had built a fortress, similar to that of Suda. For a long time the Turks made fruitless attempts to render themselves masters of this fortress; and it was not till the beginning of the last century that the Venetians permitted them to take possession of it. N. lat. $35^{\circ} 13'$. E. long. $25^{\circ} 42'$.

SPINARELLA, in *Ichthyology*, a name given by Belonius, and some other authors, to the little fish called by us the *lesser stickleback*. In the Linnæan system, this is a distinct species of the gasterosteus.

SPINATUS, in *Anatomy*, a name given by Riolanus, and others, to a muscle of the neck, called by Albinus *spinalis colli*, and by Winslow, and the other French writers, *les vertebraux externes du demi-épineux, ou transversaire épineux du col*. See SPINALIS and TRANSVERSALIS.

SPINCOURT, in *Geography*, a town of France, in the department of the Meuse, and chief place of a canton, in the district of Montmedy. The place contains 466, and the canton 9948 inhabitants, on a territory of $287\frac{1}{2}$ kilometres, in 27 communes.

SPINDLE, in *Mechanics*. See Double CONE, and MENSURATION.

The axis of the wheel of a watch or clock is called the spindle, and its ends the pivot.

SPINDLE, *Parabolic*. See PYRAMOID.

For the method of finding its solidity, see SOLIDITY.

SPINDLE, in *Sea Language*, a sort of iron-pin, tapering at the upper end to a point. It is used to stick into the upper end of the top-gallant mast, so as to carry a vane, which, turning thereon horizontally, will shew the direction of the wind. It is usually crowned with a globular or conical piece of wood, called the *acorn*, which prevents the vane from being blown off.

SPINDLE also denotes the lower end or foot of the capstan, which is shod with iron, and becomes the pivot or axis, upon which it turns in the saucer. See CAPSTAN.

SPINDLE, in *Mining*, a piece of wood fastened into either stow-blade. See STOWS.

These stows give a miner, or any other person that owns them, as good a right to a meer or meers of ground, (so that every meer have a pair of stows set on them,) as a deed of conveyance doth to any purchaser.

SPINDLE-Shell. See TRUMPET-Shell.

SPINDLE-Tree, in *Botany*. See EUONYMUS.

It is generally supposed that the euonymus of the ancients is the same plant that we at this time call by this name. The words of Theophrastus have probably given occasion to this opinion; as they found at first reading like words expressing the characters of the fruit of this tree; but on a closer inspection, they will be found to express a fruit of a very different kind. This author says, that the fruit of the euonymus is like the pod of the sesamum, marked with four protuberant ribs, and hard within, and divided into places for four orders of seeds. It is plain by this, that as their sesamum bore an oblong pod marked with four ribs, so as to seem of a quadrangular figure, so did their euonymus, and that in this long pod there were four orders of seeds, each of these orders containing a great many seeds. Now the fruit of our euonymus is short and not at all like a pod, and contains only four seeds, and not four orders of seeds; there is also this farther proof of our euonymus not being that of the ancients, that ours is a wholesome food to cattle, and they are very fond of cropping it whenever they can reach it, and never get any hurt by it; whereas the euonymus of

the Greeks was poisonous to cattle, according to Theophrastus. See FUSANUS and TETRASTOECHON.

SPINDLE-Tree, *African, or Climbing*. See STAFF-Tree.

SPINDLE-Tree, *Baylard*. See KIGGELARIA.

SPINDLING, in *Agriculture*, the act of running to seed in plants of the grain and other kinds. A great deal, in this business, depends upon the manner in which the plants are cultivated.

SPINE, in *Anatomy*, (the vertebral or spinal column; the back-bone, in common language; spina dorsii,) is the articulated bony pillar at the back of the trunk, forming the foundation or basis of support and connection to all the other parts of the frame. It is placed perpendicularly in the body, sustaining the head by its upper extremity, while its lower end rests on the pelvis. The bones of the chest, to which the upper extremities are connected, are fixed to its sides; while the ossa innominata, or the great bones, to which the lower limbs are articulated, are immovably united to it below. It is the point of attachment and support, in front, for the viscera of the thorax and abdomen, and for the great trunks of the blood-vessels. We may thus regard it as the central and most essential piece of the skeleton; as the centre of motion for the head and limbs; and the basis of support for all the great internal organs. Again; the bones which compose it give attachment to the principal muscles moving the head, the shoulders, and the arms, to those which act upon the trunk, and to some part of the abdominal muscles, and of those which move the lower limbs. Further, it constitutes a canal, which receives and protects the medulla spinalis, and gives issue to the various nerves proceeding from that organ to the trunk and limbs. The importance of the spine, on all the accounts just enumerated, is so great, that it constitutes a leading character, modifying all the other details of organization in the animals which possess it. Hence the primary division of the animal kingdom into vertebral and invertebral animals, adopted by the great modern naturalists, with Lamarck and Cuvier at their head, is founded on the presence or absence of the vertebral column.

The spine is formed of twenty-nine pieces of bone, strongly articulated to each other, and placed in succession from above downwards. The twenty-four upper ones are called vertebrae, and are farther named cervical, dorsal, and lumbar, according as they occupy the neck, back, or loins: there are seven of the first kind, twelve of the second, and five of the last. The five other pieces of the column are the sacrum, and the four ossa coccygis, which form the back of the pelvis; the first being articulated to the twenty-fourth vertebra, and the latter to the end of the sacrum and to each other.

The form of the spine is symmetrical; but the two halves do not always correspond accurately in the healthy state, and the deviations are still more remarkable in disease. As the weight to be sustained by this bony column increases constantly from above downwards, the bulk of the vertebrae, and, consequently, the strength of the pillar, increase also in the same direction, with a trivial exception or two, which will be noticed afterwards. In the attitude of standing, the vertebrae are all situated horizontally; their processes, however, deviate in various ways from this direction. They are distinguished numerically in the different regions, excepting the first and second cervical, which are commonly called atlas and vertebra dentata or axis. The general configuration of these bones is the same throughout; they are formed on a common plan, but this plan is modified in each division by circumstances peculiar to the different regions. The distribution of them into three classes is principally founded on these modifications: the classes are indeed named from their position,

position, but the diversities of their external forms characterize them. We shall first describe the general form, and then notice the particular modifications of the vertebræ.

General Form of the Vertebræ.—They consist of various irregular and prominent portions, separated by different intervals, and united by different plates. The principal part of the bone in size is the anterior prominence, called the body; it is cylindrical or oval, and represents the section of a cylinder, being terminated above and below by two flat surfaces, which give attachment to the fibro-cartilages occupying the intervertebral spaces. This body of the vertebræ forms in front a greater or less convexity, in which we observe a kind of transverse depression, bounded by two prominent edges; it is plane, or a little concave, behind, where it corresponds to the vertebral canal: in both situations there are several apertures for the passage of blood-vessels into the substance of the bone. At each side the body is continuous with the rest of the bone by a kind of pedicle.

A large oval or triangular opening, called the ring or foramen, and contributing to the formation of the vertebral canal, which holds the medulla spinalis, is placed immediately behind the body. Directly behind this opening is the spinous process, varying in form and direction in the different regions, projecting backwards beyond the level of the bone, and separated from the corresponding processes immediately above and below it, by a space filled either with muscles or ligaments.

Such are the parts of each vertebræ as come into notice on the middle line of the bone, from before backwards. When we view it laterally, we observe, 1st, two notches, a superficial one above and a much deeper below, excavated on the pedicle, which connects the body to the articular and transverse processes, and forming, when the bones are joined, those lateral foramina of the vertebral canal, through which the nerves are transmitted; 2dly, two articular or oblique processes, a superior and an inferior, furnished with cartilaginous surfaces, by which they are articulated to the corresponding processes of the bones above and below, and having this surface turned backwards or inwards in the superior, forwards or outwards in the inferior; so that each vertebræ is mechanically locked in its situation by the two vertebræ immediately above and below it; its superior articular processes being overlapped by the inferior ones of the bone above, while its inferior processes overlap those of the bone next below: 3dly, a transverse process, directed horizontally, as its name indicates, longer or shorter in the different regions, and giving attachment to muscles; and 4thly, a flattened plate, united to that of the opposite side to form the spinous process.

Particular Forms of the Vertebræ.—The various common circumstances just enumerated are greatly modified in the different regions; it is principally in the middle of each region that we must examine these modifications, which, at either end, gradually approach to the characters of the neighbouring regions.

The Cervical Vertebræ.—Their number is very constantly seven; but instances are mentioned, in which there have been eight or only six. (See Eustachius, *Ossium Examen*, p. 210; and Columbus de Re Anatomica, p. 263.) The peculiarities of form are strongly marked and distinct in this region. The first and second too, in consequence of their articulation to the head, differ widely from the others, and must therefore be described separately.

The *atlas*, or first vertebræ of the neck, deviates more than any other from the general type. It is very much expanded laterally, and its ring or foramen is very capacious. When we look at it in front, it seems to want the body, in-

stead of which we find a small bony arc, flattened in an opposite direction to that of the bodies of the other vertebræ, convex and rising into a tubercle in front, concave behind, where it bears a smooth cartilaginous surface, articulated to the odontoid process, thin above and below, where it is connected, by means of ligaments, to the occiput and second vertebræ. Immediately behind this bony arc is the large ring, larger in this than in any bone of the column, and consisting of an anterior smaller, and a posterior larger division, of which the distinction is marked by two protuberances, between which a transverse ligament is extended. The front of the ring is filled by the odontoid process; its back part is the beginning of the vertebral canal. Instead of the spinous process, and of the laminae which unite to form it, there is a posterior bony arc, about twice as large as the anterior, rising into a small tubercle at the middle, where the spinous process should be, and bounding the vertebral canal behind. The edges of this arc have ligamentous connections above and below. Instead of articular processes, the atlas possesses on each side, above, a large oval cavity, directed obliquely from behind forwards and inwards, covered by cartilage, crossed by a notch, in which a synovial gland is placed, more elevated at its outer than at its inner edge, and corresponding to the occipital condyle, with which it is articulated; below, a large, circular, and nearly horizontal plane, covered by cartilage, and articulated to a corresponding plane of the second vertebræ. A very deep channel, sometimes formed by a bony plate into a complete foramen, is placed immediately behind the superior articular concavity; it is occupied by the vertebral artery, and the first cervical or sub-occipital nerve. The inferior notch, contributing to the opening for transmitting the second cervical nerve, is behind the inferior articular plane: thus the nerves, which in all the rest of the spine go out in front of the articular processes, pass behind them in the atlas. The transverse process is very remarkable for its length, much exceeding that of any other cervical vertebræ. It is formed by a slender anterior and posterior root, between which the foramen for the vertebral artery is placed, uniting into a considerable obtuse prominence. Thus the atlas, with the exception of the thick lateral parts, to which the occipital condyles are articulated, forms nearly a bony ring.

To the tubercle of its anterior arch the longus colli and the rectus capitis internus minor are fixed: to the transverse process, the rectus lateralis, the obliquus superior and inferior, the levator scapulae, the intertransversi, and the scalenus anterior. The rectus posticus minor is fixed to the tubercle of the posterior arch.

The *vertebra dentata*, axis, epistropheus, or second vertebræ of the neck, is distinguished from all others by its odontoid or tooth-like process, and by its large, superior, articular planes. Its body exhibits above, instead of the usual superior surface, a large bony process, called the densiform, odontoid, or tooth-like, having a slightly convex cartilaginous surface in front, articulated to the back of the anterior bony arc of the atlas, a small, concave, articular face behind, on which the transverse ligament plays, and terminating above in a rather unequal obtuse extremity, from which ligaments arise, connecting it to the lateral anterior portions of the foramen magnum. The anterior surface of the body of the axis has a middle line, on each side of which it is slightly hollowed for the longi colli: the posterior, rough, and perforated by small openings for blood-vessels, forms part of the vertebral canal. The inferior surface gives attachment to the first intervertebral fibro-cartilage. The ring is as large in this as in the atlas. The plates of the spinous process

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processes are broad and thick, and the process itself is strong and prominent, projecting considerably beyond those of the succeeding bones. It is rough below, and ends behind either in an expanded knob, or in a bifurcated extremity. On each side of the tooth-like process there is a large circular and nearly horizontal plane, for articulation with the atlas. The inferior articular processes are similar to those of the other cervical vertebrae: they are oblique, placed behind the transverse processes, and have their articular faces turned forwards. The superior notches for the nerves are behind the superior planes; while the inferior are in front of the corresponding articular processes. The transverse process is small, and perforated for the vertebral artery by a foramen, which is directed obliquely upwards and outwards.

The axis is united to the head, the atlas, and the third vertebra of the neck.

To its transverse process, the splenius capitis, levator scapulæ, scalenus, transversus cervicis, longus colli, and intertransversi anterior and posterior, are affixed: to the spinous process, the rectus capitis posterior major, the obliquus inferior, the semi-spinalis cervicis, the interspinalis, and multifidus spinæ.

The five lower cervical Vertebrae.—The body is very small, in comparison to the processes and the ring; it is flattened in front, and elongated transversely, so that it is on a level nearly with the transverse processes, instead of projecting into a bony column in front of them, as it does in the other regions of the spine. It is rather thicker before than behind: its superior surface is concave from side to side, rising up laterally into two thin ridges, and rather sloping off in front: the inferior presents just the opposite conformation, so as to fit it to be received into the hollow of the vertebra below. We may notice, in front, a middle surface, corresponding to the anterior vertebral ligament, and two lateral ones, adapted to the longi colli. A small articular surface is observable on each side of the lower edge of the body of the seventh, contributing to the cavity in which the head of the first rib is lodged. The ring for the spinal marrow is large and triangular, with the angles rounded. The spinous processes are prismatic, horizontal, and either bifurcated at the end, or flattened and marked with a groove. They vary considerably in their direction, degree of bifurcation, &c. Three of the four vertebrae immediately succeeding the axis appear very small in comparison to its spinous process; but the spine of the seventh is large and prominent. The notches for the lateral foramina are placed in front of the articular processes; and the superior and inferior ones differ very little in depth. The articular processes are oval in their figure, and directed obliquely: the superior backwards and upwards, the inferior forwards and downwards. The transverse processes increase in size from the axis; there is a deep channel in the superior surface of each, lodging the anterior branch of the corresponding cervical nerve; hence the extremities are bifurcated. Each is perforated at its base by a round hole for the vertebral artery; which has been observed sometimes to be absent in the seventh.

The seventh cervical approaches in all respects very nearly to the characters of the dorsal vertebrae.

The muscles attached to the cervical vertebrae are the interspinales; the intertransversi anteriores and posteriores; the rectus anticus major; longus colli; scaleni, anterior medius and posterior; cervicalis descendens; transversalis colli; sacrolumbalis; serratus posticus superior; rhomboidens minor; trapezius; splenius capitis; and part of the rhomboideus major.

The Dorsal Vertebrae.—Their number depends on that of the ribs: they are very seldom eleven; more frequently thirteen; in which latter case there are generally only four lumbar vertebrae. Their chief characteristics arise from the articulation of the ribs to this part of the column.

The body projects in front, when compared to the vertebrae of the neck: it is thick behind, and narrower in front. The upper and under surfaces are plane. It is convex in front, a little concave behind. It is longer, thicker, larger in all respects, and more cylindrical, in proportion as we descend. The body of the first, or even of the second also, is flattened in front, like those of the cervical; but the third, fourth, fifth, and sixth, have the cordiform shape, being broad behind, and narrow in front; the seventh, eighth, and the rest, are more and more cylindrical. Generally, the third and fourth are the smallest of all. At its lateral and posterior part there is a small articular surface above and below, of which the upper is the largest. These cartilaginous surfaces form, with the corresponding ones of the neighbouring vertebrae, and the intermediate fibro-cartilages, the articular concavities, which lodge the heads of the ribs. Sometimes the first dorsal vertebra has an entire articular concavity at its upper edge, and a half cavity below: or the upper may be a half cavity also, the articulation being completed by the lower margin of the seventh cervical. In the eleventh and twelfth there is a single cavity only, placed either at the upper edge or towards the middle of the bone, and receiving by itself the head of the corresponding rib. The ring is small and circular. The plates are broad, thicker, and more perpendicular than in the neck; and they give origin to a very long spinous process, which is prismatic, pyramidal, broad at the basis, and growing narrower at the opposite extremity, which is pointed, and directed obliquely backwards and downwards. The spinous process of the first dorsal vertebra is thick, extended nearly horizontally, and ends in a flattened tubercle. The second, and particularly the third, is more slanting; the upper margin more acute; and the extremity longer and more pointed. These characters become more strongly marked in the fourth to the seventh or eighth: they are very long, and pointed, the superior edge is very acute, and the inferior surface is nearly flat; they slope so much, that they lie one over the other, in close contact, while those of the three upper and four lower stand quite apart. The effect which this arrangement must have in limiting the posterior inflexion of the column is very obvious. In the four lowest dorsal vertebrae, the depth of the spinous processes, from above downwards, is increased; they are extended more horizontally, and the length of their points is diminished. The spinous processes of the dorsal vertebrae are seldom all arranged in the same perpendicular line: one may deviate to the right, another to the left, &c. The articular processes are perpendicular, the superior being directed backwards, the inferior forwards, excepting the inferior ones of the twelfth, which are turned outwards, to be adapted to the superior processes of the first lumbar vertebra.

The transverse processes are very thick, and considerably inclined backwards: this, together with the concavity of the column in the back, enlarges the space for the reception of the lungs. When the spine is viewed laterally, the transverse processes of the dorsal are considerably behind the line of those of the cervical or lumbar regions. Each of them has a small plane, or very gently concave, surface, on the anterior part of its extremity, by which it is articulated to the tubercle of the corresponding rib. These surfaces are directed upwards in the superior vertebrae, downwards in the inferior. The transverse processes decrease considerably from

from the tenth to the twelfth; and the two last have no surface for articulation with the ribs.

The configuration of the twelfth dorsal vertebra differs very little from that of the lumbar.

To the vertebrae of this region the following muscles are affixed: *viz.* splenius capitis and colli, trachelomastoideus, biventer cervicis, complexus, longus colli, transversalis colli, semispinalis colli, semispinalis dorsi, multifidus spinæ, sacrolumbalis, levatores costarum, intertransversales and interspinales dorsi, latissimus dorsi, rhomboideus major, trapezius, ferratus posticus superior and inferior.

The lumbar vertebrae are seldom six in number, and more rarely four. Their great size, which increases down to the last, distinguishes them from those of the back and neck; while the thick fibro-cartilages, by which they are joined together, and the free space between their spinous processes, give them considerable power of motion. The bodies are large and cylindrical, with flat surfaces above and below, excepting the inferior, which is cut off obliquely, to accommodate it to the sacrum, with which it is united to form the promontory: the ring is triangular, and larger than in the neck. The laminae are thick and strong, and form a large spinous process, which is flattened laterally, terminating above and below in a thin edge, and forming a rounded end behind. That of the last is very short, and sometimes entirely wanting. The transverse processes are flattened, and rather turned backwards: it is short in the first, increases in the second and third, then again diminishes. The articular processes are perpendicular; the superior slightly concave, and the inferior proportionally convex. The former have their articular faces turned inwards and backwards; the latter outwards and forwards: the space between the superior is, therefore, necessarily more considerable than that between the inferior.

The following are the muscles attached to the lumbar vertebrae; *viz.* interspinales and intertransversales lumborum, spinalis dorsi, multifidus spinæ, quadratus lumborum, obliquus internus and transversus abdominis, sacrolumbalis and longissimus dorsi, ferratus posticus inferior, the diaphragm, the plex major and minor.

The bodies of the vertebrae consist almost entirely of spongy texture; it is covered by a very thin layer of compact bone: hence a vertebra, when thoroughly cleaned, is very light in comparison to its bulk. In the recent state it appears bloody and medullary. The circumference of the two surfaces is smooth, the centre rougher. At the same time that the cellular structure of the vertebral bodies increases the strength of the column, without adding to its weight, it makes these bones liable to those affections which belong more particularly to such structure. The compact tissue is tolerably abundant in the atlas and axis; and it predominates considerably in the processes, which, however, are cellular in their middle, and in parts where they are swelled, as at the ends of the spinous processes in the loins, &c. The ossification of the vertebrae goes on in three pieces; one for the body, and the two others for the lateral and posterior parts: yet separate points may be sometimes seen at the bases of the spinous processes. The lateral portions are united to each other behind, at the basis of the spinous process; and they are united in front to the body, at the situation of the articular processes. The atlas usually has five primitive bony pieces; one for the anterior arch, two for the posterior, and one for each side.

We have included the sacrum and the os coccygis in the enumeration of pieces composing the spine, although they are generally denominated bones of the pelvis. Their description may in truth be connected, without impropriety,

either with that of the last mentioned cavity, or of the vertebral column. They belong, however, more naturally to the latter. The sacrum is formed on the same model as the vertebrae, and consists originally of five distinct pieces, just like vertebrae, united by fibro-cartilages; differing from vertebrae only in some insignificant points of size, figure, &c. These pieces are indeed soon consolidated into one bone, which then has much less resemblance to the vertebrae than it had before. One great office of the spinal column, that of continuing and protecting the medulla spinalis, belongs equally to the sacrum. The modification which the spine exhibits in this part, arises from the attachment of the lower limbs: a large surface is necessary for this purpose, and a strong bone; and these conditions are answered in the sacrum, which in every other respect has the configuration belonging to the spine.

The sacrum (os latum, clunium) is the largest bony piece of the vertebral column, placed immediately below the last lumbar vertebra, and at the back of the pelvis; supporting, above, the head, upper limbs, spine, and superior part of the trunk, and transmitting the weight thus received from the last lumbar vertebra to the pelvis, where its broad sides are strongly tied to the ossa innominata, between which it is received like a wedge; and containing the lower extremity of the medulla spinalis. Its basis is joined to the last lumbar vertebra, in the same way as the individual vertebrae are connected to each other; its apex is united to the first bone of the coccyx. When viewed in its situation, it is not placed perpendicularly, but turned backwards, making an angle with the lumbar vertebrae, called the promontory.

The figure of the bone is wedge-shaped or triangular, with the basis turned upwards, the apex downwards, and the two sides placed laterally. It is symmetrical. It is not only broadest above, but also thickest from before backwards, and gradually diminishes downwards in both these directions. It is concave in front, and tolerably smooth, convex, and rugged behind. We shall describe its spinal, pelvic, vertebral, and coccygeal surfaces, and the two lateral sides.

The spinal surface is convex, very irregular, and covered by the origins of the muscles, which fill the lateral hollows of the spinal column. We observe in it, first, on the middle line, four eminences, diminishing in size from above downwards, analogous to the spinous processes of the vertebrae, of which they continue the series, sometimes running into a continuous bony ridge. These are the spinous processes of the sacrum, affording points of attachment to muscles. They are terminated below by a triangular opening, the end of the sacral canal, which is closed by the posterior sacro-coccygeal ligament, and bounded laterally by two prominent knobs, which are usually articulated to two corresponding ones of the coccyx. Under these, sometimes called the descending processes of the sacrum, the last sacral nerve passes. The inferior opening of the sacral canal is sometimes much more extensive, reaching nearly to the upper part of the bone, so that the canal is slit in its whole length: the opening in such instances is still occupied by ligament. 2dly. On each side, a rough depression above, for the insertion of powerful ligaments, which tie the sacrum to the os innominatum; and, lower, four posterior sacral foramina, situated in a channel continuous with that of the vertebrae, but shallower, and filled by the lumbar muscles. These holes, diminishing in diameter from above downwards, are traversed by the posterior branches of the sacral nerves, and communicate with the canal of the bone: they are bounded externally by more or less distinct prominences, which may be considered as representing the transverse processes of the vertebrae.

The pelvic surface is concave, and corresponds more particularly to the rectum. It presents, 1st, on the middle line, four slight transverse ridges, indicating the points of union between the original pieces of the bone, and separated by quadrilateral surfaces, a little concave, which answer to the anterior part of the bodies of the vertebræ; 2dly, on each side, the four anterior sacral foramina, much larger than the posterior, opposite to which they are placed, and with which they communicate by the sacral canal, diminishing in size from above downwards, giving passage to the anterior branches of the sacral nerves, and separated by bony intervals, uniting in a surface, to which the pyramidalis is attached.

The vertebral surface, representing the base of the triangle, exhibits a configuration very similar to that of the surface of a vertebra, and is adapted for union with the last lumbar vertebra. On the middle and anterior part there is an oval smooth surface, cut rather obliquely, to correspond to the oblique inferior surface of the last-mentioned bone, with which it is joined by means of a fibro-cartilage, at an angle, which forms the promontory of the pelvis. Immediately behind this is seen the orifice of the sacral canal, which has a flattened triangular figure, with the basis turned forwards, and the apex towards the spinous processes; diminishes in size from above downwards; is continuous with the vertebral canal, from which it receives the lower end of the medulla spinalis, surrounded by its membranes; communicates externally by the anterior and posterior holes just described, and terminates below at the triangular fissure already noticed. On each side of this round articulating portion the sacrum forms, in front, a smooth, convex, transverse surface, continuous with the iliac fossa, and covered by ligaments. Behind, there are two concave articular processes, facing backwards and inwards, and joined to the inferior articular processes of the last lumbar vertebra. This process is bounded in front by a slight notch, contributing to the opening for the passage of the last lumbar nerve; and behind by a thin edge, forming the lateral boundary of the sacral canal, corresponding to the margin of the vertebral laminae, and having the last of the yellow ligaments attached to it.

The coccygeal surface, representing the base of the triangle, is very small, and forms an oval face articulated to the coccyx.

The edges of the sacrum are formed into broad surfaces, for articulation with the ossa innominata. In these parts, which represent the transverse processes of the vertebræ, the resemblance between them and the former bone is the least. Each edge exhibits, above, a surface above two inches long, and an inch and a half broad, united with the os innominatum by the sacro-iliac symphysis, oblique in its direction, in consequence of the wedge-like figure of the bone, and gradually decreasing in breadth from above downwards, as the whole sacrum diminishes in thickness in the same direction. This articular surface is divided by a waving line from above downwards, into the anterior and posterior part: the former is comparatively smooth, and united by the intervention of a crust of cartilage to the os innominatum; the posterior is scabrous and irregularly excavated, to afford attachment to powerful ligaments passing between the two bones.

The coccygeal extremity, or the apex of the triangle, is an oval surface for articulation with the first bone of the coccyx.

The bony substance of the sacrum is like that of the vertebræ, cellular internally, and covered on the outside with a compact layer. It is more dense in the spinous processes.

The multifidus spinæ, the longissimus dorsi and sacrolumbalis, glutæus maximus, pyriformis, serratus posticus inferior, latissimus dorsi, and obliquus internus abdominis, are connected to the sacrum.

This bone is composed originally of five pieces, exactly resembling vertebræ, joined together by fibro-cartilages, which remain till the fourteenth year, or longer, after which the separate portions are consolidated into one bone. Hence the sacrum and os coccygis have been called the column of false vertebræ. Each of the sacral vertebræ possesses in the fœtus certain distinct bony nuclei, like those of the true vertebræ. There are five in each of the three upper ones, and three in each of the two lower. The lateral portions are consolidated first; the anterior and posterior parts later. The cartilages of the front divisions do not entirely disappear till the time of puberty, or even afterwards.

The sacrum sometimes consists of six portions; very seldom of four.

The *coccyx* (os, or more properly ossa, coccygis) is a triangular symmetrical bone, consisting of four pieces, which are united by cartilaginous ligaments in such a way as to form a continuation of the curvature of the sacrum, placed at the posterior and inferior part of the pelvis, where it supports the termination of the rectum. The first piece is the largest, and they decrease successively, but not always so: their breadth exceeds their length: they are joined by articular surfaces. The first face of the bone is convex, uneven, and marked by prominences, which indicate the original divisions. The great sacro-sciatic ligament, and the glutæus maximus, are attached to it. To the pelvic surface, which is gently concave, marked by transverse ridges, and covered by a thick ligamentous stratum, the rectum corresponds. The sacral surface is the broadest and thickest part of the bone: it has an oval concavity articulated to the sacrum, and behind that two ascending tubercles, which join the two descending ones of the sacrum, and form together the openings through which the last sacral nerves pass out. The edges are uneven, and occupied by the attachment of the less sacro-sciatic ligament: they unite below in a rounded angle, to which the levator ani is connected.

While the bones are separate, the first is the largest: it is triangular, convex behind, and concave in front; the second, third, and fourth, are circular and flattened.

The glutæus maximus, the curvator coccygis, the coccygeus, the levator ani, and sphincter ani, are inserted in this bone.

The bony substance of the coccyx is spongy, and remarkably loose and soft in its texture. In the fœtus the four pieces are completely cartilaginous, and the ossification takes place later than in the sacrum. Late in life the different portions frequently ankylose; and sometimes the bone itself is ankylosed to the sacrum: the latter event is less frequent in the female.

Articulations of the Vertebral Column.—From the great number of pieces which enter into its composition, the joints of the spine must necessarily be numerous. Moveable articulations are required, on account of the motions executed by various parts of the spine; but solidity and strength are also necessary, because the spine is the point of support of the limbs and head, the centre from which their motions proceed, and because it contains the spinal marrow, to which any injury, pressure, or shock, would be so very dangerous. Hence we find the vertebræ joined by very broad surfaces, and otherwise very strongly tied together, so that luxation is impossible, and the spine possesses as

much strength, as if it were composed of a single piece, although a power of motion is combined with that capacity for resistance. The numerous joints, and the great quantity of soft elastic matter in the spine, give a spring to all the motions of the trunk, and stop the effect of all shocks, so as to prevent their propagation, and to obviate concussion of important organs, particularly of the brain. But, besides the articulations which join the component pieces of the spine, there are several others, by which various parts are joined to the spine. Such are the joints of the head with the first and second vertebræ of the neck, and of these vertebræ with each other: these, and the motions they execute, are considered under the article HEAD. The connection of the ribs with the dorsal vertebræ is described under LUNGS. The articulation of the sacrum with the ossa innominata, and with the coccyx, and of the different pieces of the coccyx with each other, are described under PELVIS.

Articulations of the Vertebræ.—These bones are joined, 1st, by their bodies; 2dly, by their articular processes; 3dly, by their laminae; and 4thly, by the spinous processes. The mode of connection is the same throughout the spine, excepting in the case of the atlas and the axis. Of the uniting media, however, some form separate and insulated organs at each intervertebral interval; such are the fibro-cartilages, and the yellow ligaments: others constitute common organs, embracing at the same time the whole vertebral column, or its greatest part, as the anterior and posterior vertebral and the supraspinal ligaments. Yet the fibres of the latter do not run through the whole length.

The bodies of the vertebræ are united by an anterior and a posterior vertebral ligament, and by a fibro-cartilage between every two bones.

The anterior vertebral ligament, or fascia longitudinalis anterior, occupies the anterior surface of the column, extending from the axis to the upper part of the sacrum. It is not equally strong nor broad throughout: it is narrow in the neck, broader in the back, and still wider in the loins. In the first situation it is thin, stronger in the second, and again rather thin in the loins, where the tendons of the crura diaphragmatis are intermixed with it. The fibres of this ligament do not run through the whole length of the column; some end and others begin in each bone. This ligament consists of a thin stratum closely adhering to the bone, and covered, in the neck, by the pharynx and œsophagus, in the back, by the latter, by the aorta, vena azygos, and thoracic duct, and in the loins by the aorta and the inferior vena cava. At the sides it corresponds, in the neck, to the recti majores antici and longi colli; in the loins to the psoæ. It adheres to the fibro-cartilages, and to the projecting edges of the vertebral bodies, more closely than to the concavities of the latter. The more superficial fibres go from one vertebral body or fibro-cartilage to the fourth or fifth below; others belong to three bones or fibro-cartilages; and the deepest only to two. The fibres are interwoven with those on the front of the fibro-cartilages; and they leave small intervals for the passage of vessels. At the sides of this ligament in the neck, under the longi colli, are two small fibrous fasciculi for each vertebra, passing obliquely downwards and outwards from the vertebra above to that next below it.

The posterior ligament (fascia longitudinalis postica) occupies the posterior aspect of the vertebral bodies, where they form the front of the canal, extending from the axis and the occipito-axoid ligament, or apparatus colli ligamentosus, to the sacrum. It is more dense in its structure than the anterior, and appears more distinct, smooth, and shining.

The narrowest part of it is in the back: it enlarges at the fibro-cartilages, and is contracted at the bodies of the vertebræ; thus, when viewed in its whole length, it is alternately contracted and expanded at each vertebra and its neighbouring cartilage. The dura mater covers it behind, separated from it by a loose cellular tissue, never containing fat, but often much serous fluid. It corresponds in front to the fibro-cartilages and the bodies of the vertebræ, adhering less closely to the latter than to the former. Like the anterior ligament, it consists of superficial and deep-seated fibres, of which the former are the longest, and pass over three or four vertebræ, while the latter go from one bone or fibro-cartilage to the next.

The fibro-cartilages (ligamenta intervertebralia) are organs, of which the nature is little understood, holding the middle place, in point of structure, between ligament and cartilage, and occupying the intervals of the vertebral bodies throughout the column, excepting between the atlas and axis. Their form varies according to that of the bodies which they unite; and consequently is different in the neck, back, and loins. Their thickness increases successively from above downwards; so that the lumbar are separated by larger intervals than the cervical and dorsal vertebræ. Moreover, they are thicker in front than behind, in the neck: on the contrary, they are thickest behind in the back; and the arrangement in the loins is the same as in the neck: these differences are obviously connected with the natural bendings of the column. The fibro-cartilages adhere very intimately above and below to the corresponding flat surfaces of the vertebræ. In the fœtus they adhere to the cartilages of ossification; when they are removed nothing remains attached to the vertebræ; but, in the adult, the bony fibres and those of the fibro-cartilages are so completely identified, that we find no instances in the animal economy of stronger union. The circumference of these substances corresponds to the anterior and posterior vertebral ligaments: on each side, they form part of the holes through which the spinal nerves pass; and in the back they contribute to the articular cavities for the heads of the ribs.

The fibro-cartilages are formed externally of concentric fibrous laminae, numerous in front and at the sides, fewer behind, with decussating fibres, separated by more considerable intervals as we approach the centre. In the latter we find a soft pulpy tissue, increasing in quantity as the intervals increase in breadth. The fibrous laminae degenerate gradually into the pulpy structure, which occupies alone the middle of each fibro-cartilage. This tissue is most abundant in the child, where it is also soft, whitish, and even nearly transparent, while it is yellowish and thick in the adult. It becomes dense and compact in the old subject, and is constantly diminishing. To it the fibro-cartilages owe their pliancy and elasticity; while their strength resides in the laminae, which inclose this soft structure. Hence the spine is distinguished by the first property in infancy; while the other predominates afterwards. The laminae soon become red when immersed in water: the middle part swells and rises into a conical projection. If the spine be sawn through longitudinally, the fibro-cartilage swells out, on the cut surface, beyond the bone. The effect of these substances in restoring the column, when it has been bent in any direction, is very obvious. The inflexion compresses the fibro-cartilages at the bent part; and they restore themselves as soon as the compressing cause ceases to act. When the body has been long erect, the fibro-cartilages yield to the weight which presses them from above, and thus the length of the spine, and consequently of the body, is diminished: the cessation of this pressure, when the body is in the horizontal position, allows

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allows them to recover their original dimensions. See *CARTILAGE*.

The corresponding faces of the articular processes are covered by thin cartilaginous layers, and furnished with a small synovial membrane, which is very closely drawn between the opposed surfaces, and contains very little synovia. Several short and irregular, but strong ligamentous fibres, lie on this membrane.

The yellow ligaments (*lig. subflava*), so called from their colour, tie together the laminae of the vertebrae, which do not touch each other, and complete the canal of the spine, which would be otherwise open at the intervals of their laminae. The first of these ligaments is placed between the second and third cervical vertebrae; the last between the fifth lumbar and the sacrum. Each consists of two portions, a right and left, united at an angle towards the basis of the spinous process, and having at this union a small interval containing a little cellular tissue. Each portion is attached, above, to the inner surface of the superior lamina; and below to the upper edge of the inferior: hence they are hidden behind, and can only be seen to advantage from the vertebral canal; they may be best exposed by sawing out the spinous processes, and their laminae, from the vertebral column, in one continuous piece. They correspond, in front, to the dura mater, to which they are connected by a loose cellular tissue; behind, to the inner surface of the upper laminae of each interval, and to the multifidus spinæ. The angle formed by the union of the two lateral pieces is continuous in the back and loins with the interspinous ligaments: on the outside each is contiguous to the synovial membrane of the articular processes. Their fibres are numerous and closely set; longer towards the canal, where they appear smooth and polished, than towards the vertebral channel, where they are rough and uneven. There is very little cellular tissue in their composition, so that they are dissolved under ebullition with great difficulty, and resist it longer than any analogous organs. They are elastic, very strong, so that vast force is required to break them: stronger indeed than the fibro-cartilages, in which the fibres are separated by much of the pulpy texture. It is very clear that these ligaments will powerfully tend to restore the spine, after it has been inclined forwards.

The spinous processes, separated by intervals more or less considerable in different situations, are united by two kinds of ligaments; one of which connects the processes themselves, while the other envelops their points.

The interspinous ligaments (*membrana interspinalis*) occupy the intervals of the processes, but do not exist in the neck, where the corresponding spaces are filled by the interspinous muscles. Their breadth and strength increase from above downwards; in the back they are narrow, elongated, and thin, and can scarcely be said to exist in the upper part of the region. They are quadrilateral, broader and thicker in the loins, where they may offer considerable resistance to the separation of the processes. Their points of attachment are the lower edge of one spinous process, and the upper edge of the next: they correspond, in front, to the angle of union of the two portions of the yellow ligaments; behind, to the supraspinous ligaments; and on the sides, to the multifidus spinæ and longissimus dorsi. They are composed of decussating fibres.

The supraspinous ligament (*lig. quo apices vertebrarum connectuntur*) extends along the points of the spinous processes of the back and loins, from the seventh cervical vertebra to the spinous processes of the sacrum. It is very thick in the loins, where it is so interwoven with the tendinous attachments of the muscles, that they can hardly be

distinguished. In the back it is thinner and more distinct from the aponeurosis. The longitudinal direction of its fibres serves to distinguish it from the tendons, of which the fibres are oblique. Its fibres are of different lengths; the deepest go from bone to bone; the more superficial are longer, passing over one, two, or more vertebrae, and giving origin to the aponeurotic fibres of the neighbouring muscles. The skin covers this ligament behind; adhering to it by a close cellular tissue.

The ligamentum nuchæ, which arises from the cervical spinous processes, belongs more to the head than to the spine. It is described under *HEAD*.

The last vertebra of the loins is articulated to the sacrum, just in the same way as the individual vertebrae are joined together; viz. by a fibro-cartilage, by yellow ligaments, by an interspinous ligament, and by articular processes.

The Spine considered as a Whole.—The twenty-nine bones just described, viz. the twenty-four vertebrae, the sacrum, and the four ossa coccygis, are joined by the articulations which have been now explained, (all being connected by the intervention of fibro-cartilages, except the atlas,) so as to form, by their assemblage, the strong but flexible bony column which sustains the head, forms the basis of the trunk, affords a point of attachment to the upper limbs, and below is received between and supported by the haunch bones. We distinguish in it an anterior, a posterior, and two lateral regions, and two extremities. We may observe, in general, that the whole column increases in size from above downwards, as it has to support an increasing weight; but to this there are some exceptions, that will be noticed.

The anterior region, composed of the bodies of the vertebrae and the intermediate fibro-cartilages, presents in some degree the appearance of a bony pillar, which term is little applicable to the rows of bony processes, which form the lateral and posterior aspects of the spine. This region is broad in the neck, narrow in the back, and again spreads out in the loins. Its breadth in the first situation arises from the smallness and inconsiderable prominence of the vertebral bodies; in consequence of which the transverse processes in this region form part of the anterior aspect of the spine; while in the back and loins, the bodies form, by their bold convex projection, the whole front of the column. The front of the spine presents a series of superficial transverse excavations, and of prominent edges which bound them: the number of the latter is double that of the former, as each transverse channel is bounded above and below by a ridge. These excavations are confined to the front in the neck; but they reach to the sides in the middle of the column. The anterior vertebral ligament, the *recti capitis majores*, the *longi colli*, the *vena azygos*, thoracic duct, aorta, and inferior vena cava, cover the spine in front.

We observe, on the posterior aspect, in the middle line, the series of spinous processes, projecting horizontally at the upper and lower parts, and very slanting in the middle. They are separated by intervals, which are large in the neck and still more so in the loins; but very much narrowed in the back, in the middle of which the processes actually overlap. In the neck and loins there are openings between the laminae, leading into the vertebral canal, in the skeleton; but the slanting of the spinous processes covers these in the back. The points of the spinous processes are generally all in the same line; but there may be deviations, arising either from a lateral inclination of the process, or from an unnatural position of the vertebra. On each side of the spinous processes there is a longitudinal hollow, beginning at the upper extremity of the column, and ending below upon the sacrum. These lateral hollows are broad above, contracted

contracted towards the middle, and narrow below. They are formed by the series of vertebral laminæ, separated by larger or smaller spaces, which are occupied by the yellow ligaments. They are filled by the vertebral muscles, particularly by the multifidus spinæ.

The series of transverse processes occupies each lateral region; but they have not all the same direction: they are more anterior in the neck and loins, and thrown backwards in the back. Between them in the neck, and in front of them in the back and loins, there is a succession of large holes, increasing in size from above downwards, and giving passage to the vertebral nerves. In front of these, in the back, are the surfaces for articulation of the heads of the ribs.

The superior extremity, articulated to the occiput, forms a right angle with it on each side; and an anterior and posterior angle, which vary according to the flexion or extension of the head. This extremity presents, from before backwards, the anterior arc of the atlas, the tooth-like process, the commencement of the canal, and the posterior arc of the atlas. On each side of the canal, towards the front, there is the concavity for the occipital condyle, and the large transverse process. The inferior extremity presents merely the small rounded point formed by the last bone of the coccyx.

The length of the spine does not vary greatly in different individuals; the differences of stature depending more on the limbs than on this column. In malformations, however, where it is curved in various directions, the stature is much affected; and the limbs, although not exceeding their ordinary size, appear disproportionately long. We have already observed, that the compression of the fibro-cartilages by the weight which they naturally support, diminishes the length of the spine after long standing; and that the column recovers its former length by repose in the horizontal posture. This effect is less strongly marked in the old subject, where the fibro-cartilages are very dense, and consequently do not easily yield to pressure.

The size of the column increasing from above downwards, in proportion to the greater weight and more powerful effects it has to support, it may be regarded as a pyramid, of which the basis is below, and the apex above. Yet this augmentation is not gradual throughout; and the column may be considered as the assemblage of four pyramids. The upper end, including the atlas and axis, destined for articulation with the head, which it supports, is larger than the immediately succeeding part of the neck. From the third to the seventh cervical vertebra the spine is gradually expanded: thence, to the third or fourth dorsal vertebra, it contracts again; and is gradually augmented from the latter to the basis of the sacrum: it contracts again from the basis of the sacrum to the apex of the os coccygis. Measured transversely, the spine increases from the third cervical to the fifth dorsal vertebra, while the remaining dorsal and the lumbar vertebrae are nearly of the same breadth, or increase very slightly downwards. The depth of the vertebrae is also increased; but the inferior cervical are all nearly of one depth.

The intervertebral intervals are nearly of uniform size, down to the third dorsal; from which they increase downwards. The flat surfaces of a vertebra are always parallel to each other, and the intervals are consequently of the same depth before and behind. There is an exception, however, of the parts in which the column is bent; the intervals of the third, fourth, fifth, and sixth dorsal vertebrae being narrowest in front, while those between the fourth and fifth lumbar, and the sacrum, are broadest in front.

The spinal column is straight, when viewed before or be-

hind; and might be divided by a perpendicular line into a right and left corresponding half: but, when we view it laterally, we find that it is bent in several parts, so as to describe a waving line, in which each anterior prominence is accompanied by a corresponding posterior convexity. The cervical portion projects slightly in front; the dorsal is decidedly convex behind. The concavity of the dorsal part of the spine combines with the inclination backwards of the transverse processes to increase the capacity of the thorax. The greatest depth of this concavity is opposite to the lower bone of the sternum. In the loins, the spine is again convex in front, while the sacrum and coccyx slant backwards remarkably, so as to present a deep concavity. The middle of the first convexity corresponds to the fourth cervical vertebra; that of the succeeding concavity to the seventh or eighth dorsal; the middle of the lumbar projection to the junction of the fifth lumbar vertebra with the sacrum; and that of the sacral concavity to the middle of the bone. About the third, fourth, and fifth dorsal vertebrae, the spine is sometimes a little convex towards the right. This has been ascribed to the presence of the aorta; but that cause is manifestly inadequate. The explanation, which is grounded on the greater use of the right arm, and a consequent inclination of the trunk to the left side, in order to afford a firmer point of support, appears rather more probable. Any habitual attitude, particularly when persisted in from childhood, will affect the direction of the vertebral column. Under various diseased states, remarkable curvatures are produced; in which we find that the vertebrae and their fibro-cartilages become accommodated to the unnatural position, being greatly diminished in depth on the concavity of the curve, so that the two surfaces are no longer parallel. It is also constant, that a bend in one part renders curvature necessary in another, in order to preserve the centre of gravity in a straight line. The position of the head and upper limbs is also calculated to maintain the equilibrium of the body; and thus nearly the whole frame is influenced by a cause originally affecting only a part of the spine.

The canal of the spine extends throughout the column, excepting a small portion of the lower end of the sacrum and the os coccygis: it is continuous, above, with the cavity of the cranium, and ends below on the back of the sacrum. It does not occupy the centre of the column, being placed much nearer to the posterior part. In the neck it is large; more ample in the upper than in the lower part of the back, the narrowest part being from the sixth to the ninth: it expands a little in the eleventh and twelfth dorsal vertebrae, is very large in the lumbar, and again suddenly contracted in the sacrum. Its figure is triangular, with the angles rounded; so that it has an anterior, and a right and left surface; it is more nearly round in the middle, and quite triangular in the sacrum. It partakes of all the curvatures of the spine. It is formed in front of the backs of the vertebral bodies and fibro-cartilages, covered by the posterior ligaments. Behind, the laminæ and the yellow ligaments compose it. On each side it presents a series of twenty-nine large foramina for the passage of the nerves; or there are thirty, if we include the exit of the first cervical pair, between the occiput and the atlas.

This canal is lined by a prolongation of the dura mater, including the medulla spinalis, covered by its arachnoid coat and pia mater. (See BRAIN and NERVOUS System.) The dura mater is surrounded by a loose cellular tissue, containing serous fluid.

Development of the Spine.—Few parts of the skeleton undergo more remarkable changes in the progress of ossification than the vertebral column. It differs much in the child and

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and the adult; and in old age is again very different from both.

It is one of the first parts formed in the embryo, where it seems to be a kind of foundation, on which the structure of the body is erected. Its form is discernible at the end of the third week after conception, when we can just see the head and a curved line connected to it. Long before the extremities can be seen, the spine continues visible. The commencement of its ossification by numerous points may be dated about the end of the second month. The gelatinous spine, or carina, as it has been called from its incurvated keel-like shape, is the first trace of development in the incubated egg.

The formation of the spine is more advanced, and its size more considerable, in comparison with other parts, particularly with the pelvis and lower limbs, at the time of birth. Hence the trunk is proportionably longer. The general stature too, at this time, depends on the spine, while in the adult it is influenced more by the lower limbs. This great length of the spine corresponds to the depth of the cranium, which is much more considerable proportionally in the fœtus and young subjects than in the adult. The vertebral canal being also large, the breadth of the column, which depends much on the size of the canal, is considerable. All parts which relate to this excavation are much advanced. On the contrary, whatever has reference to support or locomotion, is little developed at this time. The spinous processes do not exist; consequently the points of attachment for the muscles are weaker. The bodies are still in great measure cartilaginous: behind, where they contribute to the canal, they are the most formed; but there is much soft substance in front, where, when the spine is dried, we see merely a series of rounded bony tubercles. Such a state is very unfavourable to the solid support which is necessary for preserving the erect attitude. At this age, the transverse processes are small in the loins, where they relate to the muscles only; they are much more considerable in the back and neck, on account of their connection with the ribs and the vertebral artery.

The column, at this time, does not form a pyramid, of which the basis is downwards and the apex upwards. The cervical portion is larger than the lumbar, on account of the development of the transverse processes, which, being placed nearly on the same line with the bodies, give to the former region a considerable volume; and of the comparatively imperfect state of the lumbar vertebræ. The dorsal and lumbar regions are nearly equal in size; but in some instances the former vertebræ are largest. As the principal effort, in standing, is supported by the loins, the imperfect state of the lumbar vertebræ is very unfavourable to the maintenance of that attitude in the newly born child. The imperfectly developed state of the bones coincides with the inconsiderable volume of the pelvis.

The direction of the column is remarkable in the fœtus: it is straight, or at least exhibits the hardly sensible commencement of those curves, which it will present in the sequel. In consequence of this straightness, the vacillations which occur in the erect posture of the body, and in all the motions executed in that posture, are much more sensible, and the centre of gravity is more easily carried beyond the basis of support. Hence another reason why newly born children cannot keep themselves upright, or move in that attitude.

The vertebral column, in early age, is small and narrow in front, particularly at the back and loins. In consequence of the want of spinous processes, there is great flexibility, particularly backwards. The latter property is favoured by

the large quantity of soft substance in the column; the cartilaginous portion of the vertebral bodies being added to the fibro-cartilages. The vertebral channels are very shallow, in consequence of the state of the spinous processes. The lateral holes are very large: the last lumbar vertebræ does not form so marked an angle with the sacrum. The upper end of the column does not differ materially from its state in the adult.

As ossification proceeds, all the peculiarities just enumerated gradually disappear. The erect attitude is more secure, and progression is performed with greater facility. Hence the support of the trunk by all the limbs, is a result of the organization of the fœtus. The child, having crawled about for some time, gradually experiences those developments of its bony and muscular fabric, which enable it to appear in the erect posture as a biped. The vertebral column, however, arrives at the state which we have described as existing in the adult, by a very slow progression. At the time of puberty, in both sexes, the atlas and the coccyx are complete. In the six lower cervical vertebræ, the processes are not yet consolidated to the body; and the vertebræ of the back and loins are still less complete, having a bony plate at each surface of the body, and a bony nucleus in the spinous process. Slight marks of the original separation are still visible in the sacrum. In a few years these imperfections disappear; the apices of the spinous processes of the back and loins being among the last parts that are consolidated.

In the old subject, the intervertebral fibro-cartilages shrink and become harder: sometimes, but very rarely, they ossify. The spine, at this age, generally bends forwards, apparently from debility of the posterior muscles: thus, the force which should counterbalance that tendency to fall forwards, arising from the position of the viscera in front of the spine, is gradually lost. To counteract this inclination of the spine forwards, and support the centre of gravity, the pelvis recedes, and the knees and legs project in front. The latter circumstance is more strongly marked in proportion as the inclination of the spine forwards is more considerable. The weight of the trunk being carried towards the front, the base of support must move forwards also. There is always an exact proportion between the bending of the spine, the receding of the pelvis, and the advance of the knees. In this case, the trunk and lower limbs together exhibit the same phenomenon as the spine itself in its particular curves, which balance each other in the neck, back, and loins.

Mechanism of the Spine.—This must be considered in three points of view: 1st, with reference to the canal; 2dly, as the point of support of the trunk; and 3dly, as the centre of the motions performed by the latter.

1. *Of the Canal.*—All the arrangements about the vertebral column are calculated to ensure the safety of this part. The breadth of the vertebral bodies; the multiplicity and strength of the uniting ligaments; the parts lying in front of the spine in the neck, chest, and abdomen; and the thick muscular masses that fill the vertebral hollows behind; all concur in protecting the contents of the canal from external injury. Hence the resistance which the spine opposes to all efforts directed against it; a resistance which renders luxation impossible. The individual vertebræ are capable of so very slight a motion, that the medulla spinalis cannot be compressed in any inflexions of the spine.

2. *Mechanism of the Spine in Standing.*—Here the spine is the point of support of the trunk, of which it transmits all the weight, together with that of the head, to the pelvis.

The mode in which the head is supported on the spine, is considered under the article **HEAD**. The part in front of the articulation certainly preponderates over that behind; but

but the difference is less considerable, than it would appear from noticing merely the relation of the occipital condyles to the front and back of the head, in consequence of the anterior portion containing the face, of which the weight does not correspond to the bulk, while all the posterior part is solid and heavy.

If the position of the head tends to incline the spine forwards, the same effect is much more strongly produced by the situation of the pectoral and abdominal viscera wholly in front, without any thing to counterbalance them behind. The muscles of the vertebral channels, inserted either in the ribs or the vertebræ, exert a constant effort in opposition to that of the anterior viscera, maintaining by their exertion the vertebral column, and, consequently, the trunk, in the erect attitude. The greatest effort is below, where the spine supports the most considerable weight. Here the muscles are thicker, the bones large, and their processes more prominent. Here, too, the sense of fatigue is felt after long standing; whence arises the practice of tying a firm band round the loins, to support the muscles and favour their action.

Thus, in standing, the spine is placed between two forces acting in opposite directions; an anterior passive one, which is the trunk; a posterior active one, the action of the extensor muscles. The habitual tendency of the spine to bend forwards, produced by the weight of the viscera, is further obviated by the hip-joints, at which the trunk is sustained on the lower limbs, being placed in front of the sacro-iliac symphyses. The basis of the trunk occupies the space between the latter symphyses and the cotyloid cavities. It will be readily understood that falls must have been much more frequent, if the thighs had been articulated on the same line with the sacrum. The waving line described by the vertebral column, and allowing extensive motion in the upper parts, without the line of gravity, which passes through all the curves, abandoning the base of support, is another disposition very favourable to the solidity of the trunk in its erect attitude. The gradual increase in size of the column, from above downwards, contributes to the same end. Thus, standing cannot be regarded, by any means, as an attitude of repose; it requires great efforts, which naturally cause considerable lassitude, if the posture be long maintained.

3. *Motions of the Spine.*—The general motions are, forwards, backwards, to either side, or in the intermediate directions. Inclination forwards, or flexion, as it is commonly termed, is the most extensive, as all our principal efforts have this direction. In this motion, the anterior vertebral ligament is relaxed; the fibro-cartilages are loosened in front, and stretched behind; the posterior vertebral ligament, the yellow ligaments, and those of the spinous processes, are stretched. The laminae of the fibro-cartilages, being much more numerous in front than behind, yield more readily to motion in the former than in the latter direction. In extension, we observe phenomena exactly contrary to these. The muscles, however, which produce extension, being fixed to the vertebral processes, are very near the centre of motion, and, consequently, act less powerfully than the flexors, which operate through the medium of the ribs, and, consequently, at a distance from the centre of motion. The spinous processes, too, particularly of the back, limit extension very much.

In inclination to either side, the fibro-cartilages are principally affected; being stretched on one side and relaxed on the other. The ribs principally limit this motion, by coming in contact with each other.

All these motions are much more sensible at the junction of the dorsal and lumbar regions than elsewhere. When they are all performed in succession, the trunk is carried round in

a circular direction, describing a cone, of which the basis is upwards, the apex downwards.

Besides the motions just enumerated, a power of rotation has been ascribed to the spine, in which the vertebræ are supposed to be twisted on their axes. Winflow admits this, and Bichat does the same; adding, however, that it can only be accomplished with considerable difficulty. He calls it a species of general twisting, in which all the ligaments are stretched, resulting from the partial twisting of each fibro-cartilage. When we consider how the vertebræ are joined together; when we reflect on the nature of the fibro-cartilages, on the yellow ligaments, on the mechanical locking of the articular processes, and more particularly on the attachments of the ribs, and the overlapping spines in the back, we shall begin to doubt whether this rotation be possible. Dr. Barclay decidedly denies it. (*Muscular Motions*, p. 337, et seq.) If the head and shoulders be prevented from moving on the trunk, and the pelvis be also kept motionless, no rotation of the spine can be effected. An appearance takes place, which might be ascribed to such a rotation, from a motion of the pelvis on the hips. This may easily be detected, by placing a rod of some feet in length across the pelvis, when any motion of the latter will be immediately visible at its extremity.

The motions vary in each region: on account of the smallness of the vertebræ, the obliquity of the articular processes, the shortness and horizontal projection of the spinous processes, which are not tied together by interspinal ligaments, the quantity of motion in all the directions already enumerated is considerable. The cervical region either represents a simple lever, or it may be considered, in connection with the head, as an angular lever, and will follow all the motions of that part. In one part of this region there is a true rotatory motion; it is at the articulation of the atlas with the axis. Whenever the head is twisted to one side or the other, there is a revolution of the former bone on the latter, and not any general twisting of the spine.

Every thing concurs to limit motion in the back: for example, the articulations of the ribs to the bodies and transverse processes, and their connection to the sternum in front; the length and overlapping of the spinous processes.

In the loins, again, there is free motion; particularly above, at the junction of this region with the back.

The motions of the individual vertebræ are extremely obscure; but they take place in the same direction as the general motion which we have just described. The visible movement of any part of the spine results, therefore, from the combined effect of several hardly sensible motions: one vertebra could not move sufficiently on another to produce a perceptible motion of the trunk. This circumstance concurs with several others relating to the mode of union of the vertebræ, and the mechanical confinement of the articular processes, to render luxation impossible: meaning by that term, a displacement of the bone without any fracture. The effort is distributed over a considerable region, and cannot therefore act sufficiently on a single bone. Neither can any force be easily applied before or behind, sufficient to drive out one vertebra from its place. Moreover, were such a force actually applied, the vertebra could not be displaced forwards without a fracture of its inferior, nor backwards, without that of its superior articulating processes.

Of the muscles which are concerned in these motions, some act directly on the trunk, while others affect it through the medium of the ribs, the scapulae, &c. All of them, being placed on the right or left side of the body, must have the power of moving the trunk laterally, more or less, according to their degree of obliquity, or their distance from the

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mesial plane. The following is a list of the muscles which carry it forwards; including both those which act directly and the indirect ones.

Pectorales majores and minores; ferrati magni; obliqui externi abdominis; obliqui interni abdominis; transversi abdominis; recti abdominis; pyramidales; psoæ magni and parvi.

The muscles moving it backwards are, trapezii; rhomboidei; latissimi dorsi; ferrati postici superiores and inferiores; sacrolumbales; longissimi dorsi; spinales dorsi; semi-spinales dorsi; multifidi spinæ; interspinales; intertransversarii dorsi and lumborum; quadrati lumborum.

The muscles of the neck may be arranged in like manner into the two classes of (1) those which incline it forwards; and (2) those which incline it backwards. In both classes, those which are to the right or left of the mesial plane, will inspect the cervical column to their respective sides. These lists include, besides the muscles which act immediately on the neck, those which influence it through the head.

1. Muscles bending the neck forwards: latissimi colli; biventre maxillæ; mylo-hyoidei; genio-hyoidei; genio-hyoglossi; omo-hyoidei; iterio-hyoidei; thyro-hyoidei; iterio-mastoidei; recti capitis interni majores and minores; recti capitis laterales; longi colli; scaleni antici.

2. Muscles bending it backwards: trapezii; rhomboidei minores; ferrati postici superiores; splenii capitis and colli; complexi; trachelo-mastoidei; cervicales descendentes; transversales cervicis; spinales cervicis; semi-spinales cervicis; multifidi spinæ; recti capitis postici majores and minores; obliqui capitis superiores and inferiores; scaleni postici; and levatores scapularum.

The scaleni medii and intertransversales can only inspect laterally.

SPINE, Disease and Curvature of, in Surgery. In the present article we intend to consider a particular disease of the spine, attended with a total or partial abolition of the power of using, and sometimes even of moving, the lower extremities.

It was that eminent surgeon Mr. Pott, who gave the first accurate description of this serious affliction. To this distemper, he observes, children are the most subject; adults are by no means exempt from it; but it hardly ever affects persons after the age of forty. In infants, the true cause of the paralytic disorders of the lower limbs is seldom discovered by parents or nurses, who never imagine that it is situated in the back-bone. When the disease affects a child who has been able to walk, the loss of the use of his legs is gradual, though not very slow. He at first complains of being very soon tired, and is unwilling to move about much; and very shortly afterwards he frequently trips and stumbles, although there be no impediment in his way. Whenever he attempts to move briskly, he finds that his legs involuntarily cross each other, by which he is frequently thrown down. Upon endeavouring to stand erect, even for a few minutes, his knees give way and bend forward.

When the distemper is a little farther advanced, it will be found that the patient cannot, without much difficulty and deliberation, direct either of his feet precisely to any exact point; and very soon after this, both thighs and legs lose a great deal of their natural sensibility, and become perfectly useless for all the purposes of locomotion. In adults, Mr. Pott observed, that the progress of the disease was rather quicker than in children.

The affection of the lower limbs is somewhat different from a common nervous palsy. The legs and thighs are rendered unfit for all the purposes of locomotion, and do also lose much of their natural sensibility; but they have neither

the flabby feel which a truly paralytic limb has, nor that seeming looseness at the joints, nor that total incapacity of resistance, which allows the latter to be twisted in almost all directions. On the contrary, the joints are often very stiff, and the feet frequently cannot be placed flatly on the ground, in consequence of the toes pointing downward.

The disease of the spine varies in situation, extent, and degree; being either in the neck, back, and sometimes, though very seldom, in the upper part of the loins; sometimes comprehending only two vertebræ, sometimes three, or more.

Some patients are rendered totally incapable of walking at a very early period of the distemper; others can manage to move about with the help of crutches, or by grasping their own thighs with their hands.

When a weak infant is the subject, and the curvature resulting from the morbid state of the spine is in the vertebræ of the back, it is not unfrequently productive of deformity, by rendering the back humped, and by alterations which the position of the ribs and sternum undergoes, in consequence of the flexure and morbid state of the spine.

The general health does not seem at first to be materially affected; but when the distemper of the spine has made much progress, many complaints come on, such as difficulty in respiration, indigestion, pain, a sense of tightness in the stomach, obstinate constipations, purgings, involuntary discharge of the urine and feces, &c.

The paralytic affection of the legs is certainly owing to the particular state in which the spinal marrow, surrounded by the diseased vertebræ, is placed. When the distemper has existed only a short time, the ligaments connecting those vertebræ which form the curve are somewhat thickened and relaxed, and the bodies of the bones affected with a change, similar to what takes place in the heads of the bones in cases of white-swelling. (See WHITE-SWELLING.) When the complaint has been of longer existence, the ligaments are now manifestly thickened, and the bones more obviously altered, and even becoming carious. The quantity of elastic substance between the bodies of the vertebræ is much diminished; and, after death, in advanced cases, the bones are always found carious, while a quantity of sanious fluid is lodged between them and the membrane investing the spinal marrow. The corpora vertebrarum, howsoever softened, diseased, or rendered carious they may be, are never found spread and enlarged in their texture. Mr. Pott was well convinced that the bones were not expanded. The disease seems to be very analogous to the affection of the heads of the bones in the scrofulous white-swelling, and as we know that this latter disorder is commonly unattended with any real increase in the dimensions of the diseased parts of the bones, we ought indeed to expect that no such change would prevail in the distemper now under consideration.

The convexity of the curvature is always from within outwards, and is invariably preceded, as well as the paralytic affection of the legs, by a distempered state of the ligaments and bones.

The only thing from which relief is ever obtained in the present distressing affliction, is an issue, made on each side of the spinous processes of the affected vertebræ. The best mode of forming the issue is to rub the potassa cum calcé upon the skin until the part turns brown. To accomplish this object in a neat manner, it is as well to cover and defend the integuments with adhesive plaster, excepting the two longitudinal portions, about half an inch broad, which are to be converted into eschars by the application of the caustic. The end of this substance is to be dipped in water, and freely rubbed on the situation of the intended issues. As

soon as the skin has become quite brown, the caustic may be washed off with some wet tow, the adhesive plaster may be removed, and the part covered with a linseed poultice.

Immediately the eschars are loose, and can be taken away without pain, the issues are to be filled with peas, or kidney-beans. These are to be covered with adhesive plaster, which will confine them in their situation. However, as the hollows soon become filled up with granulations, unless considerable pressure be made, it is generally deemed necessary to bind a piece of pasteboard, or a compress containing a bit of sheet-lead, firmly on the situation of the issues. The pressure thus maintained, though creative of uneasiness at first, will, in the end, save the patient an immense deal of pain; for, in consequence of its operation, the peas or beans will soon form as many little hollows in the cavity of the issue as their own number, and into these the future peas may afterwards be put and retained, without the least uneasiness, provided the surgeon gives particular injunctions not to allow the bandage to be ever slack. The pressure saves the patient, in the end, a great deal of pain, which would otherwise be unavoidable, on account of the surgeon being necessitated to repress the rising granulations in the cavity of the issue, by sprinkling them with powder of cantharides, or the pulv. ex ærug. æris et fabinæ, or even rubbing them with the caustic. In most instances, however, it is now and then requisite to apply one of the above powders underneath the beans or peas. In order to apply peas advantageously, they should be previously softened in warm water, and connected together like beads, by passing a thread through their centre. Then they should be allowed to become completely dry, when they are fit for immediate use. There should always be a greater length of thread than of peas, by which means, two little portions at the ends of the peas may extend beyond each extremity of the issue, and be fixed there by two small bits of adhesive plaster. This little contrivance will have great effect in keeping the whole row of peas in its right situation. When the issue is more than half an inch in breadth, two rows of peas should be placed in it.

It is said that a string of beads answers quite as well as one of peas or beans, and certainly it is more convenient, as, when regularly washed every day, it may be used as long as the surgeon thinks proper; and thus the trouble and expence of getting fresh peas or beans may be avoided.

The issues are to be kept open until the cure is complete; that is, until the patient perfectly recovers the use of his legs, or even for some time afterwards. Mr. Pott judiciously recommends the practitioner to heal at first only one of them.

In conjunction with the issues, bark, sea-air, and sea-bathing, are frequently proper.

There have been various contrivances proposed for the purpose of affording mechanical support to the spine. This method does not, however, promise to be useful. When the morbid affection of the corpora vertebrarum has advanced to a certain state, the adjoining sound bones, both above and below the seat of the disease, become approximated to each other, and at length ankylosed. This salutary process, if influenced at all by mechanically supporting the spine, must obviously be retarded. From this account we also see the reason why the projection of the spinous processes, at least in adult subjects, must always remain. In children, however, a great diminution, and even an entire removal of a certain degree of deformity, may take place during the growth of the body. Pott's *Chirurgical Works*, vol. iii. Cooper's *First Lines of the Practice of Surgery*, edit. 3, part 2.

SPINE, in *Agriculture*, a term signifying provincially the surface turf, sod, or sward of land.

SPINE, a sharp, firm, hard point which is sent off from the woody parts of some sorts of plants. It consequently differs from a prickle, which only rises from the bark of the plant. The spines in plants of this nature are produced either singly, as is the case in most of them; doubly, or by pairs, as in some particular sorts; or in a triple manner, as in the three-thorned acacia.

SPINES of *Echini*, in *Natural History*. These in their fossil state make a great appearance in the cabinets of the curious, and in the works of the learned, and are of an almost infinite variety of kinds; and many of them are of the same figures and dimensions with those of the echini now living in our own and other seas, and well known to us. But beside these, there is an almost infinite variety of others, which, though allowed on all hands to be truly spines of some echini or other, yet evidently differ from those of all the known recent fish of that name, and have certainly belonged to a species of it, of which we have not now the least knowledge. These, however different in shape from one another, yet all agree in their texture and constituent matter.

SPINEDA, in *Geography*, a town of Italy, in the department of the Upper Po; 4 miles N.N.E. of Sabionetta.

SPINELL, or *True Ruby*, *Spinelle* of Haüy and Broch, in *Mineralogy*. (See GEMS.) The colour of this gem is red, blended with tints of blue or yellow; and it occurs in grains, in small rounded fragments, and crystallized. The primitive form of its crystals is the regular octohedron, exhibiting also the varieties of the cuneiform octohedron, the primitive octohedron with the edges of the common base truncated, the same with all the edges truncated, and the primitive octohedron divided obliquely into two segments, which are turned on each other $\frac{1}{4}$ th of a circle, thus forming a solid with alternate salient and re-entering angles. The crystals are small and very small, rarely middle-sized. The faces of the octohedron are smooth, and the planes of the truncatures are longitudinally striated. Its lustre, externally and internally, is brightly shining, vitreous. Its cross fracture is conchoidal, its longitudinal fracture is lamellar in three directions. It varies from translucent to transparent. It is considerably hard, though in this respect inferior to sapphire. Sp. gr. 3.57—3.64. Before the blowpipe it is infusible without addition, but melts with borax, acquiring a green colour. When ground to a very fine powder, it is soluble by long digestion in boiling sulphuric acid. It was first analysed by Klaproth, and afterwards by Vauquelin, with the following results:

	Klaproth.	Vauquelin.
Alumine	- 74.5	82.47
Silex	- 15.5	0.
Magnesia	- 8.25	8.78
Oxyd of iron	1.5	0.
Lime	- 0.75	0.
Chromic acid	- 0.	6.18
	100.50	97.43

Although its geological situation is not known, it occurs imbedded in calcareous spar and adularia, accompanied by mica and magnetic pyrites. See GEMS. See also CORUNDUM. Aikin's *Dict.*

Mineralogists formerly classed all varieties of ruby with spinell, and also the oriental ruby or sapphire. The cochineal-variety of spinell is the Balais ruby of the jewellers, so called from Balachan, the Indian name of Pegu, where it is found. The violet-blue spinell is the almandine of Pliny; it is named from Alabanda, a town in Lesser Asia. The orange-yellow variety is the rubicelle ruby of jewellers. A newly discovered

discovered variety of spinell is called by Werner Salam stone, the name by which it is known in India; its colours are red and blue. It is crystallized in six-sided prisms, variously truncated. It is in general only translucent, and exhibits a pearly light on the surface. It is somewhat heavier than true spinell, but in other characters agrees with it. It is found in the peninsula of India.

SPINET, *Spinetto*, Ital. *Esfinette*, Fr. from *spina*, a thorn, or quill, the tone being produced by a crow's quill inserted in the tongue of a little machine called a jack. (See JACK, and TONGUE.) The instrument consists of a chest or belly, made of the most porous and resinous wood to be found, and a table of fir fastened on rods, called the found-board, which bears on the sides: on the table are raised two little prominences or bridges, in which are fixed as many pins as there are strings on the instrument. See BRIDGE.

It is played with keys, like the virginal, or small piano-forte; the long keys are for the diatonic or natural notes, and the short for the flats and sharps. See KEYS, and SCALE.

The keys, when pressed down at the end by the finger, on the principle of the lever, make the other end throw up jacks, which strike the strings, and cause the sound by means of the quills with which they are armed.

The thirty thickest strings are of brass; the others, for the more delicate tones, are of steel or iron-wire, fastened at one end by hooks, and at the other on pins, by which they receive their tension over the bridges already mentioned.

The figure of the spinet is like that of the harpsichord, a horizontal harp, and the harp an inverted spinet. It is tuned in the same manner as other keyed instruments, by 5ths and 8ths, with or without bearings, as the tuner or the owner of the instrument shall please.

There have been spinets and harpsichords made for curious people with some or all the short keys split or cut in two for harmonics, or at least to perfect some of the extraneous keys, furnishing a different tone for F \sharp and G \flat , D \sharp and E \flat , &c. to perfect some of the most offensive keys in common tuning. Zarlino had an instrument of this kind made at Venice, which we saw at the house of Percezzi, the composer's widow, and it was afterwards sent to England; but the mechanism and tone were so bad, that no tuning could render its sounds agreeable. There are quarter-notes, as they are called, in the Temple organ, to three of the five short keys; but except in psalmody, or very slow movements, Stanley never ventured to touch them.

We have seen spinets made by Haywood, in the time of James and Charles I., with box keys for the natural notes; by Keen and Slade, in queen Anne's time, with the long keys of ebony and the short of ivory; and excellent spinets by the two Hitchcocks, father and son, with ivory natural keys, and ebony or dried pear-tree for the sharps and flats.

The spinet had but a single string to each note. As the spinet rivalled the virginal, the small piano-forte has supplanted the spinet in the public favour; and we believe that very few have been made since the middle of the last century.

SPINIAGOR, in *Geography*, a town of Russia, in the government of Viatka; 40 miles S.W. of Elabuga.

SPINIFEX, in *Botany*, from *spina*, a thorn, and *facio*, to make, because of the thorny nature of its involucreal leaves.—Linn. Mant. 2. 163. Nov. Gram. Gen. 29. t. 1. Schreb. Gen. 744. Willd. Sp. Pl. v. 4. 1129. Mart. Mill. Dict. v. 4. Brown Prodr. Nov. Holl. v. 1. 198. Juss. 30. Lamarek Illustr. t. 840.—Class and order, *Poly-*
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gamia Dioecia; rather *Triandria Digynia*. Nat. Ord. *Gramina*.

Gen. Ch. *Cal.* Common Involucrum of two lanceolate, channelled, unequal, spinous-pointed leaves; partial of about four similar ones. Flowers on awl-shaped clustered receptacles, naked above. Perianth of two equal valves, containing one or two florets. *Cor.* of two lanceolate convoluted valves, the innermost enfolding the organs of fructification. *Stam.* Filaments three, capillary; anthers long, linear, cloven at each end. *Pist.* Germen oblong; styles two, thread-shaped, longer than the glumes; stigmas villous, prominent. *Peric.* none, except the hardened corolla, united to the oblong, smooth, solitary seed.

On one plant the flowers are situated at the base of each receptacle, each calyx containing two florets, and the anthers are most perfect in one, the stigmas in the other. On a separate plant the florets are solitary, all male, and numerous along the lower part of each receptacle.

Ess. Ch. Involucrum of two spinous leaves. Calyx of two valves, two-flowered. Corolla of two valves. Seed united to the hardened corolla.

Some flowers male, on a separate plant.

1. *S. squarrosus*. Linn. Mant. 2. 300. Willd. n. 1. (*Stipa spinifex*; Linn. Mant. 1. 34. *Cyperus littoreus*; Rumph. Amboin. v. 6. t. 2. f. 2.)—Smooth. Leaves channelled, rigid, spinous-pointed, rough at the edges.—Native of the sandy sea-shores of the East Indies. A large, rigid, tough, shrubby grass, whose surface is smooth and glaucous. Leaves three or four inches long, with broad sheathing bases, rough-edged. Flowers in large, terminal, aggregate and compound heads, the spinous points of their receptacles and involucreal leaves projecting in every direction. These heads are blown to a great distance by the wind, and roll along the sands with great velocity.

2. *S. longifolius*. Brown n. 1. (*Cyperus*; Peron, Voy. aux Terres Austr. v. 1. 113.)—"Smooth. Leaves flaccid, semi-cylindrical, unarmed, smooth-edged, thrice as long as the seed-bearing receptacle. Glumes of the male flowers rough."—Gathered by M. Baudin, in the tropical part of New Holland. Brown.

3. *S. fragilis*. Br. n. 2.—"Smooth. Leaves flaccid, semi-cylindrical, unarmed, rough-edged, longer than the seed-bearing receptacle."—Observed by Mr. Brown, in the tropical part of New Holland.

4. *S. sericeus*. Br. n. 3.—"Silky. Leaves unarmed, smooth, like their sheaths, at the inside. Point of the male receptacle several times shorter than the spike."—Found by Mr. Brown in the last-mentioned country, as well as in New South Wales.

5. *S. hirsutus*. Br. n. 4. Labill. Nov. Holl. v. 2. 81. t. 230, 231.—Silky. Leaves unarmed, villous as well as their sheaths. Point of the male receptacle nearly equal to the spike.—Native of the south coast of New Holland.

SPINIS. *Attachamenta de Spinis & Bosco*. See ATTACHAMENTA.

SPINNEY, in *Rural Economy*, a term signifying provincially a clump of trees, or small grove or plantation.

SPINNING, the art of combining animal or vegetable fibres into threads or cords, by twisting them together. Wool, silk, cotton, flax, and hemp, are the matters most commonly employed for spinning into threads; and of these, most of the vegetable fibres, except cotton, require to be wetted during the operation of spinning, to render them more supple; but cotton, wool, and silk, are spun in a dry state.

The machines employed for spinning are of very different kinds,

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kinds, and adapted to the materials to be operated upon ; but they have all a spindle, revolving with a rapid motion, to twist the fibres which are attached to the end of it, and are supplied in a regular quantity, as fast as the twisting motion of the spindle will form them into a thread ; and there is also some provision of a bobbin upon the spindle, to take up and retain the thread when made.

The most ancient mode of spinning is by the spindle and distaff, and this method is the simplest of all others. The spindle is nothing more than a piece of hard wood, made round, and sharp-pointed at one end, so that it can be made to spin upon its point, in the same manner as a child's top : the upper part is reduced to a pin or peg, and it is this part which has the fibres united to it, the lower or enlarged part being only to give sufficient weight to make it spin. The spinner must be seated upon the ground, and after having put the distaff in motion upon its point, by twirling it between the hands, get it up to a rapid motion, by striking it occasionally with the hand, with a motion very similar to that by which a child keeps up the motion of his whipping-top, when he draws the lash of a whip round it.

The flax, or material which is to be spun, after being properly prepared, is lapped round the end of the distaff, which is nothing more than a stick that the spinner holds in the left hand, so as to be conveniently situated to draw off from it a few fibres at a time, with the finger and thumb of the right hand, to form the thread. The upper part of the spindle, which is made smaller, like a pin, has the ends of the fibres which are to form the thread attached to it before it is put in motion. These fibres are drawn out of the bunch which is wound upon the distaff, and held between the finger and thumb, so as to be in the direction of the length of the spindle ; therefore, when the spindle is once made to revolve, it twists these fibres together, to form a thread, and as fast as the thread forms, the spinner draws off more flax from the distaff, and guides the fibres between the finger and thumb, so that they shall be regularly delivered out, and make an even thread. The motion of the spindle is constantly kept up, by striking it as often as the hand can be spared from the operation of guiding the thread. When by these means as great a length of thread is formed as is convenient to reach from the end of it to the spindle, the thread is wound upon the outside of the small part or pin of the spindle, for which purpose the spinner applies the fore-finger against the thread, close to the end of the spindle, and bends the thread at that part, so that it will be at right angles with the direction of the spindle, instead of being nearly in the direction of its length ; and also, that it will be guided opposite to the middle of the pin, or small part of the spindle, instead of being at the extreme end thereof. In this situation the motion of the spindle, which is continually kept up, occasions the thread to wind up, or lap upon the pin of the spindle, instead of twisting round upon itself, as in the former case ; but when nearly all the length of thread is thus disposed of, the finger is removed from the thread, and it immediately assumes its original direction, by slipping to the extreme end of the spindle, so as to be twisted round itself by the motion of the spindle, and more fibres are now supplied to it from the bunch upon the distaff, to form a fresh length of thread. In this manner the spinning proceeds, until as much thread is spun and wound upon the pin of the spindle as will make a moderate sized ball.

This simple and inconvenient method of spinning becomes very efficient, when the spindle, instead of being spun upon the ground, is mounted in a proper frame, and turned by a wheel

and band ; this forms a machine which is called the one-thread wheel, and is still used in the country for spinning wool : the spindle is made of iron, and placed horizontally, so that it can revolve freely ; and the extremity of the spindle, to which the thread is applied, projects beyond the support.

The wheel which turns it is placed at one side, the pivots of both being supported in upright pieces, rising up from a sort of stool. The spinner puts the wheel in rapid motion by its handle, and its weight is sufficient to continue the motion for some seconds ; then walking backwards from the spindle, in the direction of its length, she supplies the fibres regularly, and the motion twists them into a thread ; but when a convenient length is spun, the spinner steps on one side, and reaches out that arm which holds the end of the thread, so as to alter the direction of the thread, and bring it nearly perpendicular to the length of the spindle, which motion gathers or winds up the thread upon the middle of the projecting part of the spindle. This being done, she holds the thread in the direction of the spindle, so that it will receive twist, and retreats again to spin a fresh length of thread. For spinning wool, it is not wound round the distaff the same as flax, but the spinner holds a lock of it, doubled over the fore-finger, and draws away the fibres from the middle part of the lock, to do which with regularity is the great art of spinning by hand.

A spinning-machine more perfect than this is the one-thread flax-wheel, with spindle and flyer ; it has the property of constantly drawing up the thread as fast as it is spun, instead of spinning a length, and then winding it upon the spindle. For this purpose the spindle is made longer than the other, and is turned by a band and wheel ; but the wheel receives motion from the foot by a small treadle, because the spinner sits before the wheel to work the spindle, which is supported upon its two extreme ends, and near one end the flyer is fixed ; this is a piece of wood curved to an arc, the vertex of which is fixed on the spindle, and from the extremities of the arc two arms proceed, so as to be parallel to the spindle, and at such a distance from it as to admit a wooden bobbin to be fitted loosely upon the spindle ; and at the same time the arms of the flyer can revolve round the bobbin without touching it. The end of the thread is fastened to the bobbin, and conducted through a hook fixed in the flyer, so that it proceeds from the circumference of the bobbin to this hook, in a direction perpendicular to the bobbin, but turns round the hook so as to come into the direction of the spindle. The thread is then conducted through a perforation made in the centre of the end of the spindle or pivot, upon which it revolves, and to this end of the thread the fibres are supplied. The twisting motion given by the revolution of the spindle forms them into a continuation of the thread, which is gathered up upon the bobbin as fast as the spinner lets it go through her fingers, by a tendency which the bobbin has to turn slowly, at the same time that the flyer to which the thread is hooked is revolving rapidly round the bobbin. For this purpose a string is passed round a small neck upon the bobbin, and one end of the string being fastened to the frame, the other has a small weight to draw it tight round the neck of the bobbin, and occasion friction. In other spinning-wheels, a second band from the great wheel is made to turn the bobbin more slowly than the spindle. The thread which passes over the hook of the flyer is rapidly carried round the circumference of the bobbin ; but as the bobbin follows the motion of the flyer, it only winds up as much thread upon the bobbin as the difference of the two motions ;

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and this tendency to wind up can be increased or diminished at pleasure, by the friction which is occasioned by the string or band which passes round the neck of the bobbin. When the winding-up of the thread upon the bobbin has accumulated a ridge of thread upon it opposite to the hook in the flyer, the thread must be shifted to another hook opposite to a different part of the bobbin, for which purpose the arms of the flyer are furnished with different hooks, and this must be repeated several times, until the whole length of the bobbin is filled; it is then taken off to be reeled, and replaced by another empty bobbin.

An improvement was made in the spinning-wheel by Mr. Antis some years ago, which was an application of what Sir Richard Arkwright had before invented. The object is to obviate the necessity of stopping the wheel to remove the thread from one hook to another, in the manner just described. For this purpose, the bobbin is made to move regularly backwards and forwards upon the spindle a space equal to its length, so that every part will, in succession, be presented opposite the hook over which the thread passes, and thus receive the thread regularly upon the whole length of the bobbin. The additional parts necessary for producing this movement are as follow: a pinion of only a single leaf is made to project from the extremity of the pivot of the great wheel, or a worm or endless screw formed on the end pivot, will answer the same purpose, which is to actuate a wheel of seven inches diameter, and ninety-seven teeth; therefore ninety-seven revolutions of the great wheel will produce one revolution of this smaller wheel; upon the face of which a circular ring of wire is fixed, and supported from the wheel by six legs, so as to be oblique to the plane of the wheel, as it touches it at one part, and at the opposite side of the ring projects nearly three-fourths of an inch. This ring of wire gives motion to an upright lever, about fifteen inches long, and moving on a centre at three inches from its lower extremity, where it has a pin fixed in it, and resting against the oblique ring of wire; therefore, when the wheel turns round, it communicates a small motion to the lever, in consequence of its obliquity to the plane in which it revolves. The upper end of the lever is connected to an horizontal sliding-bar, situated beneath the spindle, and having an upright piece of brass, which works in the notch of a pulley, formed on the end of the bobbin, and drives the bobbin backwards and forwards upon the spindle, according as the oblique ring of wire forces the pin at the lower end of the lever in or out, when the wheel moves round. To regulate and return this alternate motion, a small weight hangs by a line to the sliding-bar, and, passing over a pulley, rises and falls as the bobbin recedes and advances, and tends constantly to keep the pin at the lower end of the lever in contact with the wire. It is evident, from this description, that one staple only is wanted to the arms of the flyer, which being placed near the extremity, the thread passes through it, and by the motion of the bobbin, is laid regularly upon it from one end to the other.

The invention has also another advantage over the old method, which always winds the thread in ridges upon the bobbin; and if the thread breaks in reeling the yarn, the whole bobbin may as well be thrown away, because the thread cannot easily be found again; but this improved wheel always winds the threads across upon one another, by which means the end can never be lost.

In order to regulate the friction on the bobbin, and retard its motion in a greater or less degree at pleasure, there is a neck of brass or steel fastened to one end of it, and embraced by a kind of small vice, or pincers, fixed to the

sliding-bar. This vice must be made either with two elastic springs with wooden tops, or of wood wholly, and faced with leather; but if made of wood only, then a spring must be made beneath the shoulder of the screw, to answer the same purpose. By tightening this screw more or less, the friction on the bobbin may be regulated to the greatest nicety, provided the springs are of a strength rightly proportioned to their functions. It will readily appear, that all this may be done without the least effect on the velocity of the whole machine, as thereby nothing is added to the general friction so as to obstruct it.

It was not until the latter end of the last century, that spinning-machines of greater powers were constructed; but all threads were spun by one of the machines which we have described; the first being used for cotton and wool, and the other, with the bobbin and flyer, for flax; but for very coarse threads, two spindles were applied to the latter machine, and the spinner having the wool wound round a band, tied it round her waist, instead of winding it upon a distaff, and was thus able to draw out fibres with each hand, and supply two spindles. And of the other simple spindles, several were made to turn together by the movement of one large horizontal wheel, around which the spindles were arranged in directions radiating from the centre, and each spindle received a rapid motion by the contact of the edge of the large wheel, which was turned round by one person. The spinners each stood opposite to his respective spindle, so as altogether to occupy a large apartment, and by this means they could do much more work than formerly, having none of the interruptions of turning the wheel.

The first improvement of any importance in spinning, was that of the spinning-jenny, invented by Hargraves, as related in our article COTTON; and the machine itself will be described under the article WOOLLEN *Manufacture*. This machine consists of a number of spindles, similar to those of the one-thread wheel, which are all mounted, in a perpendicular direction in the same frame, and turned round by one large wheel, situated in an horizontal direction, and put in motion by a crank at the upper end of its spindle. The threads from each spindle are conducted nearly in an horizontal direction, but being quite at the point or upper extremity of the spindles, do not wind upon the spindles, but will receive twist, because the threads slip over the top of the spindles as they revolve. The threads are guided between two rulers of wood, called the *claps*, instead of the finger and thumb of the spinner. These rulers are made to fit together, so as to hold the fibres between them, and are fitted up with wheels at the end to run upon the frame, and thus advance or retreat at pleasure from the spindles. It was not attempted with this machine to spin a finished thread immediately from the lock of wool or cotton, but coarse and loose threads are previously prepared on the hand-wheel, which can be done with great rapidity, and the coppins or balls of these loose threads are placed in the jenny, and conducted, first between the claps or rulers before mentioned, and then to the spindles. By this means, when the carriage of the claps is drawn backwards from the spindles, the claps being separate, the threads draw between them from off the coppins, and at the same time that portion of each thread which is between the claps and the ends of the spindles, receives its twist; but having drawn out a certain length of each thread in this manner, the claps are shut together; and the motion of the spindles, as also the retreat of the claps, is continued, by which means the threads are stretched out to their intended fineness, and being thus finished, the threads are wound upon the spindles, by being brought opposite to the middle part

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of the spindles by a rail of wood, called the *faller*, which moves upon centres, so as to descend horizontally before all the spindles, and depresses all the threads together, so that they will wind up by the motion of the spindles, and as they wind, the clasps return towards the spindles. The operations are then again repeated, and thus continued, until the coppins or balls of thread, wound upon the spindles, acquire their proper size.

The next improvement in spinning-machines was the introduction of the *slubbing-machine*, or *billy*, for preparing the rovings for the jenny; an operation which was at first performed by the hand-wheel. This machine has similar parts to the jenny, but they are differently arranged, to adapt it to spin the wool as it comes from the carding-machine, in the state of cardings, which are locks of wool drawn out to about the size of caudles, and from two to three feet in length. For this purpose the spindles are made to travel on the carriage, and the clasps stand still, being the reverse of the jenny. The cardings are laid upon an endless cloth, which revolves over two rollers, and lies in an inclined position at the end of the machine; and one carding is laid upon the cloth opposite to each spindle, the ends being pieced with fresh cardings by children, as fast as the spindle works them up. A roller presses down upon the cardings, to hold them fast upon the feeding-cloth, and to make them move with it; and just beyond this roller the clasps are fixed to hold the rovings, when the proper lengths are drawn out by the retreating of the spindles, which, as before stated, are situated in the carriage. The operation of the billy is the same as that of the jenny, *viz.* that the carriage is drawn out, and the feeding-cloth revolves over its roller to give out the cardings until a certain length: the clasp is then shut down, and the further extension of the threads is produced by stretching; which being done, the threads are wound upon the spindles.

The inventions of Sir Richard Arkwright soon superseded these machines. His principal invention in the spinning was the introduction of the rollers, to draw out or extend the fibres to their full length, which is by this means much more perfectly performed than by the fingers of the spinner. For the immediate twisting of the thread, he adopted the spindle, bobbin, and flyer of the old flax-wheel, placed in a vertical position, but added to it the important improvement of raising and lowering the bobbin, to distribute the thread regularly and equally upon all the length of it, the same which we have before described as being applied by Mr. Antis to the common spinning-wheel. A full description of this machine, which is called the *water spinning-frame*, will be found in the article *COTTON MANUFACTURE*, *Plate IX. Cotton Manufacture*.

The spinning-jenny was again introduced, and rendered equal, and for some purposes superior, to the water-frame, by Mr. Crompton, who combined with it the system of rollers of Sir Richard Arkwright, and called it the *mule*. It is also fully described under *Plate XI. Cotton Manufacture*. See *COTTON MANUFACTURE*.

The great success which attended the spinning of cotton by these machines, induced many persons to attempt the spinning of flax and wool by similar means. Short wool, for the manufacture of cloth, is spun by the billy and jenny; but flax and long wool for worsted require very different treatment from cotton and short wool, particularly the flax, owing to the great length of the fibres, and to their being of such irregular lengths: in consequence, when they are extended by the rollers, on Arkwright's principle, some fibres will be broken, if the distances between the rollers is too small; and on the other hand, if the distance is too

great, the fibres will not be properly extended. The latter, however, is the least evil of the two; and, in consequence, the spinning-frames for flax have the rollers, between which the extension or drawing out is effected, placed at a distance of from 14 to 18 inches between the first two pair of rollers, through which the flax passes; the next two pair six or eight inches; after which it is passed between the third pair of rollers at a distance of five or six inches, and then delivered to the spindles, which are similar to those of the water-frame, but placed in an inclined position. The rollers are made in a very different manner from those for cotton, being only narrow wheels just wide enough to receive the fibres of flax between them; and the fibres are prevented from getting out sideways by small tin spouts, through which the flax passes, as the rollers draw it forwards. The reason of this is, that the flinty surface of the flax would soon wear a hollow part round a plain roller, which would then let the flax slip through; but the narrow wheel wears down equally over the whole breadth of its edge. The lower pair of these rollers, or wheels, revolves in a small trough of water: in the same manner as a grind-stone, and thus keeps the flax constantly wet, which is necessary, in order to soften the fibres, and make them spin into a firm and smooth thread.

Worsted is also spun in a frame resembling the water-frame of Arkwright, from which it only differs in the relative distances of the rollers, by which the drawing out or extending of the fibres is effected.

Mellis Clarke and Bugby obtained a patent in 1806, for improvements in a machine for spinning hemp and flax, which is intended to be worked by hand labour, and to be at such a small expence, as to bring it within the reach of small manufacturers. The inventors state it to be constructed upon such safe and easy principles, that no length of experience is necessary to enable children to work it; and that it occupies so little space, that the machines may be placed in small rooms, out-buildings, or other cheap places. To effect the above purposes, it was necessary to get rid of the flyer fixed upon the spindle used in the old machinery for spinning hemp or flax, which additions require a power in proportion of five to one; and also to surmount the difficulty which arises from the want of elasticity in these substances, and which prevents them from being spun, by stretching out at the same time that the thread is twisted, in the manner of the mule or jenny.

These patentees recommend a machine, which is in fact a mule with certain modifications; and to give the effect of elasticity in the fibres, they have two methods. The most simple, and that which they particularly recommend, is to provide a holder of large wire for every spindle, which holders are several inches in length, fixed in an arbor or shaft, that extends from one end of the carriage to the other.

This arbor or shaft, with the holders, may be considered as an enlarged and improved substitute for what is called the *faller* in the mules or jennies for spinning cotton, and the wire-holders fixed therein have elliptical eyes at their extremities, through each of which a thread is conducted in its passage from the rollers which draw out the thread to its spindle. The wire of which the holder is made, after forming the elliptical eye, is left or extended beyond the uppermost part, something in the manner of a cork-screw, so that the yarn may be conveniently slipped in when occasion may require it. These holders for each thread are for the purpose of keeping the yarn in a state nearly vertical over the tops of the spindle, when the carriage which contains them is coming out; and as they will readily yield or spring from the vertical position, they have the same effect as elasticity

in the fibres of the substance which is to be stretched out; but the wires being removed from the vertical situation at the beginning of the return of the carriage, and thrown into nearly a horizontal position, by inclining the shaft into which they are all fixed, they bring the yarn below the tops of the bobbins or quills which are fixed upon the spindles, which will then wind up the threads upon them when the spindles are turned round, and then the wire-eyes being regularly curved, and raised up again by the motion of an elliptic wheel, which is turned round by the machine, they distribute the yarn regularly upon the bobbins or quills, and prevent it from hinkling, and improperly doubling or twisting together. Another method of compensating for the want of elasticity in hemp and flax, is to fix a round bar of wood, about an inch and a half in diameter, the whole length of the carriage, about three or four inches above the tops of the spindles, so that the outer surface, or that next the person who works the machine, may be perpendicular, or nearly so, over the tops of the spindles, the inner side having pieces of wood or metal fixed or nailed thereto, leaving only small spaces or notches between each, for the yarn to pass through. The use of these pieces is to prevent the threads from getting together and entangling. Every thing relating to the wire-holders before mentioned, and the arbor to which they are affixed, must be applied in concert with these pieces of metal, which form a separation between the threads.

The art of spinning, which nature has given to many animals of different kinds for their preservation, and other purposes, is not confined to the inhabitants of the earth or air alone, but is even extended to those of the sea. M. Reaumur has shewn, by a series of curious experiments, that the common muscle, and some other shell-fish of the sea, possess it in a great degree of perfection. See *MUSCLE*.

But he observes, that though the workmanship is the same, the manner of producing it is very different. Spiders, caterpillars, and the like, make threads of any length that they please, by making the viscous liquor, of which they are formed, pass through a fine perforation in the organ appointed for this spinning: but the way in which the muscles form their threads is very different, as the former resembles the work of the wire-drawer, so does this that of the founder, who casts metals in a mould. The canal of the organ destined for the muscle's spinning, which, from its shape, is commonly called its tongue, is the mould in which its thread is cast, and gives it its determinate length. *Mem. Acad. Par. 1711.*

SPINNING-Wheel, in *Rope-making*, for twelve spinners to spin yarn at the same time, is about five feet in diameter, and is hung between two posts fixed in the ground: on its top is fixed a semi-circular frame, called the head, which contains twelve whirls, that turn on iron spindles, with hooks to their front ends to hang the hemp on, and are worked by means of a leather band encircling the wheel and whirls. The whirls are made to run with a truer motion when the head on the rising side of the hand has a larger segment of a circle than the falling side; or in other words, let the base part of the head be longer from the middle than the opposite or falling side, by which means the band will be kept equally tight over the whirls, and consequently the motion be alike to all. N.B. Heads made in this manner have the wheel turned always the same way.

SPINO, in *Geography*, a town of Italy, in the department of the Upper Po; 8 miles W.N.W. of Crema.

SPINOLA, *AMBROSE*, in *Biography*, one of the most celebrated generals of his time, was born in 1569. His family was noble, and originally from Genoa. His brother

Frederic, general of the galleys stationed in the Low Countries, in the service of Spain, engaged him to bring a body of 9000 Italian and Spanish veterans into Flanders, where he soon distinguished himself by his valour and good conduct. He marched against the famous prince Maurice, and it was agreed between him and king Philip that he himself should pay his own soldiers, to be reimbursed afterwards; by which regulation, while the other Spanish troops were extremely disorderly and mutinous for want of their pay, those under his command were patterns of obedience and strict discipline. He was commissioned to raise some additional regiments, in order that he might undertake, in concert with his brother, some important expedition, but the death of the brother, in a sea-fight with the Dutch, put an end to the project. The town of Ostend had been in a state of siege nearly three years, and small progress had been made towards its reduction; for which reason the archduke Albert, governor of the Netherlands, resolved to commit the whole management of it to Spinola. Before he took upon himself the management of this business, he sent some officers to examine the works, and though they differed in opinion as to probability of success, the love of glory induced him to accept the charge. His plans succeeded, and the place surrendered after the end of the third year, having, it is said, cost the lives of 100,000 men. Spinola was rewarded with honours of every kind, and at the conclusion of the campaign, he went to Madrid, and obtained the rank and office of camp-marshal-general, and commander-in-chief of the Spanish and Italian troops. He passed through Paris, and had an interview with Henry IV., by whom he was interrogated as to the plan of the ensuing campaign, of which he gave a faithful account. The king, taking for granted that his intention was to deceive, wrote to prince Maurice just the contrary of what he had heard from Spinola, and afterwards, when he found his mistake, he said, "Others deceive by telling falsehoods, but this man by telling the truth." Spinola now put into execution his design of carrying on the war into the enemy's country, and crossing the Rhine, he penetrated into Overijssel, where he took several places, in which he left considerable garrisons. His progress was at length stopped by prince Maurice, and these two great commanders exhaulted the whole art of war during that and the following campaign, in keeping each other in check. Both parties at length becoming weary with war, a congress was appointed in 1608 to treat of peace at the Hague, and Spinola was at the head of the deputies on the part of the archduke. Wherever he came the people flocked to gain a sight of so celebrated a commander, and they were met at Dordrecht by prince Maurice, who treated his antagonist with the greatest respect. The difficulties arising in the progress of the negotiation were so great, that a truce only could be concluded. In 1621 the war was renewed, on account of a disputed succession to the countries of Cleves and Juliers, and Spinola being placed at the head of an army, penetrated into the latter country and reduced its capital. Prince Maurice was again his opponent, who was not able to prevent the fall of Cleves, or the investment of the strong town of Breda. While this siege was going on, prince Maurice died, and Spinola was brought into a dangerous state of health. The siege was, however, carried on with great vigour, and the town was defended with equal resolution. At length, it becoming evident that the garrison could not hold out any longer, Spinola, in admiration of their valour and perseverance, offered them the most honourable terms of capitulation. These were accepted, and the garrison, greatly reduced, marched out. Spinola drew up his army to salute them, and as they passed, he paid particular compli-

compliments to the governor and principal officers. He distributed money among the soldiers, provided with the utmost attention for the cure of the sick and wounded, and conveyed the rest in the most commodious manner possible to the next fortrefs. Having fulfilled the duties of a hero, he resigned his command, as having no longer an equal foe in the field with whom he could contend. In 1627, passing from Antwerp to Madrid, he took Rochelle in his way, in order to witness the memorable siege of that place. Richelieu consulted him on the best means of bringing it to a conclusion. "Shut the port," he said, "and open the hand;" meaning thereby, that the besiegers should be liberally treated.

The court of Spain recalled Spinola from the Low Countries in 1629, and sent him into Italy, where he in the following year took Casal. The citadel, however, remained in the hands of the French, owing to the impediments thrown in his way by orders from Madrid. The anxiety and vexation which this circumstance occasioned, co-operating with disease, put an end to his life in the same year, at a moment when he was at the summit of his military reputation. It is said that his great antagonist, prince Maurice, gave this testimony to his character, when being asked who was the first captain of the age, replied, "Spinola is the second."

SPINOLETTA, in *Ornithology*, the name of a small bird of the lark kind, the *alauda spinoletta* of Linnæus, called *tordino* by the Venetians, and seeming to be the *stopparola*, as also the *grifola* and *spipola*, of Aldrovandus. It is smaller than the common lark; its head, neck, shoulders, and back, are of a greyish colour, with an admixture of green; its breast and belly white, and its throat spotted; the female differs from the male, in that her belly is yellow; the wing-feathers are of a dusky brown, with whitish or yellowish edges; its tail is moderately long, and part of the feathers are snow-white, the rest brown or blackish; the length of the heel distinguishes this bird from all others, except the lark kind, and it differs from all the species of larks in the colour of its beak and legs, which are black. It is common in the markets of Venice and other places. Ray.

SPINOSA, in *Zoology*, the name by which the Italians call the porcupine.

SPINOSE LEAF, among *Botanists*. See **LEAF**.

SPINOSI PISCES, in *Ichthyology*, such fishes as have some of the rays of their back fins running out into thorns and prickles, as the perch, &c. See **FISH**.

SPINOZA, in *Biography*. See the next article.

SPINOZISM, or **SPINOSISM**, the doctrine of Spinoza; or, atheism and pantheism proposed after the manner of Spinoza.

The great principle of Spinozism is, that there is nothing properly and absolutely existing, but matter and the modifications of matter; among which are even comprehended thoughts, abstract and general ideas, comparisons, relations, combinations of relations, &c.

Benedict de Spinoza, or Espinoza, was a man well known in Holland. He was born at Amsterdam, in the year 1632, being a Jew both by descent and education; but at an early period of his life he manifested such dissatisfaction with the religion of his fathers, and advanced opinions so contrary to their established tenets, that a sentence of anathema was pronounced against him by his brethren. Having been excommunicated from the synagogue, some Christians, who were attached to him, afforded him an asylum, and gave him an opportunity of acquiring a knowledge of the Latin and Greek languages, and of studying the Cartesian philosophy. But as he still continued with great

vehemence to attack the religion of his countrymen, they attempted first to silence him by bribe, offering him an annual pension of 1000 florins, and afterwards to take him off by assassination. Both these measures proving ineffectual, they accused him, before the magistrate, of apostasy and blasphemy; and he was banished from the city. In his exile, he studied mathematics and natural philosophy, and procured a subsistence by polishing optical glasses. He resided chiefly at Rhenburg, where he was often visited by the followers of Descartes, who consulted him on difficult questions. At their request he published, in 1664, "The Principles of the Cartesian Philosophy demonstrated geometrically," with an appendix, containing metaphysical opinions altogether inconsistent with the doctrine of Descartes. In order to escape the odium which was occasioned by this publication, he retired to a village not far from the Hague, whither he was followed by many of his countrymen and foreigners, who were inclined to adopt his doctrines. The elector palatine invited him to occupy the chair of philosophy at Heidelberg; but apprehending that his liberty would be abridged, he declined the proposal, and continued to live in retirement, with great sobriety and decency of manners, until a consumption brought him to an early end, in the year 1667.

Spinoza composed several books in Latin; the most celebrated of which is his "Tractatus Theologico-Politicus," printed at Amsterdam in 1670, in which he attempts to overturn the foundation of all religion: the book, accordingly, was condemned by a public decree of the States; though it has since been sold publicly, and even reprinted, both in Latin and French, in that country, and in English at London.

In this work Spinoza insinuates, that all religions are only political engines, calculated for the public good, to render the people obedient to magistrates, and to make them practise virtue and morality.

He does not here lay down his notion of the Deity openly, but contents himself with suggesting it. In his "Ethics demonstrated geometrically," published among his posthumous works, he is more open and express; maintaining, that God is not, as we imagine him, an infinite, intelligent, happy, and perfect Being; nor any thing but that natural virtue, or faculty, which is diffused throughout all creatures.

His other posthumous treatises are entitled "Politics," "On the Improvement of the Understanding," "Epistles and Answers," and a "Hebrew Grammar." The various impieties contained in these treatises excited general indignation; and refutations were issued by writers of all religious persuasions, who concurred in amply exposing the empty sophisms, the equivocal definitions, the false reasonings, and all the absurdities with which his writings abounded.

The life of Spinoza has been accurately written by Colerus, whose performance was published at the Hague in 8vo. in 1706. But a more ample and circumstantial account of this singular man has been given by Lenglet du Fresnoy, and is prefixed to Boulainvilliers's Exposition of the Doctrine of Spinoza, which was published at Amsterdam, in 12mo., in 1731. Fresnoy republished the work of Colerus, and added to it several anecdotes, borrowed from a Life of Spinoza, written by Lucas, a physician at the Hague.

The learned Fabricius, in his *Bibliotheca Græca*, lib. v. part iii. p. 119, and Jenichen, in his *Historia Spinozismi Lehnhofiani*, p. 38—72, have given an ample list of those writers who have refuted the system of Spinoza. Witsius in

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in Holland, Majus in Germany, and De la Mothe in England, wrote against his *Tractatus*; but Bredenburg, according to Mr. Bayle, succeeded best on this subject; who, however, is said to have been afterwards a convert to Spinozism, and to have written a demonstration of the truth of it: a refutation of his defence by Isaac Orobio, a learned Jewish physician at Amsterdam, was published in 8vo. 1703. See also Buddeus's *Theses de Atheismo et Superstitione*, c. i. sect. 26; and Fabricius's *Syllab. Script. de Verit. Relig. Christ.* p. 357, &c. Mr. Bayle, and above all Dr. Clarke and Dr. Cudworth, have distinguished themselves by their refutation of the system of Spinoza. See Bayle's *Dict. art. Spinoza*, and Clarke's *Demonstration of the Being and Attributes of God*, p. 25—45, &c. ed. 1725. Cudworth's *Intellectual System*.

Spinoza, in his *Tractatus* above-mentioned, is very full on the subject of the authors of the scriptures; and endeavours to shew, that the Pentateuch is not the work of Moses; contrary to the common opinion, both of the Jews and Christians. He has also his particular sentiments as to the authors of the other books. This part of the work has been answered by Mr. Huet, in his *Demonstratio Evangelica*; and by M. Simon, in his *Hist. Crit. du Vieux Test.* See **PENTATEUCH**.

Spinozism is a species of naturalism, or pantheism, or hylotheism, as it is sometimes called, *i. e.* of the dogma which allows of no other God but nature, or the universe; and, therefore, makes matter to be God. Accordingly, Buddeus, in a dissertation "*De Spinozismo ante Spinozam*," proves at large, that Spinoza's doctrine of God and the world, is far from being his own invention, but that it had been held by many philosophers of different sects, both among the Chaldeans and Greeks. It is certain, the opinion of the Stoics, and of those who held an *anima mundi*, was not far from it. Lucan introduces Cato discoursing thus:

"Estne Dei sedes nisi terra, et pontus, et aer,
Et cælum, et virtus? superos quid quærimus ultra?
Jupiter est quodcumq; vides, quocumq; moveris."

Luc. Phars. l. 9. v. 578.

Strato likewise, and others among the Peripatetics, maintained something very like it; and, what is more, though no ancient sect seems farther removed from Spinozism than the Platonic, as they attributed the greatest freedom to God, and carefully distinguished him from matter; yet Gundlingius has proved at large, that Plato gave matter much the same origin with Spinoza. But the sect that approached nearest to Spinozism was that which taught, that all things were one, as Xenophanes the Colophonian, Parmenides, Melissus, and especially Zeno Eleates; whence it obtained the name of the "*Eleatic System of Atheism*." To the same may also be reduced the opinion of those, who held the first matter for God, as Amalricus and David of Dinantum. Add, that the sect of Foe in China and Japan, and that of the Soufi in Persia, and that of the Zindikites in Turkey, are found to philosophize much after the manner of Spinoza.

The impious system of Spinoza was so ingeniously maintained, that it found many patrons in the United Provinces, among whom were Lewis Meyer, who republished Spinoza's works, and who himself wrote a work entitled "*Philosophy the Interpreter of Scripture*," and Van Leenhof, an ecclesiastic of Zwoll, who wrote a piece entitled "*Heaven in Earth*," of the doctrine of which he was obliged to make a public recantation. Others, under the pretence of refuting Spinoza, secretly favoured his system.

The chief articles in Spinoza's system are reducible to these: that there is but one substance in nature; and that this only substance is endued with an infinite number of attributes, among which are extension and cogitation: that all the bodies in the universe are modifications of this substance, considered as it is extended; and that all the souls of men are modifications of the same substance, considered as cogitative: that God is a necessary and infinitely perfect Being, and is the cause of all things that exist, but is not a different being from them: that there is but one being, and one nature; and that this nature produces within itself, by an immanent act, all those which we call creatures: and that this being is at the same time both agent and patient, efficient cause and subject; but that he produces nothing but modifications of himself.

As Spinoza taught, that there is no difference of substances, he maintained, that the whole and every part of the material world is a necessary existing being, and that there is no other God, but the universe: and, moreover, since it is absolutely impossible for any thing to be created or produced by another, and also absolutely impossible for God to have caused any thing to be in any respect different from what it now is; every thing that exists must needs be so a part of the divine substance, not as a modification caused in it by any will or good pleasure or wisdom in the whole, but as of absolute necessity in itself, with respect to the manner of the existence of each part, no less than with respect to the self-existence of the whole; consequently the material world, and every part of it, with the order and manner of being of each part, is, upon this scheme, the only self-existent, or necessarily existing being.

And he also maintains, that motion, as a dependent being, has been eternally communicated from one piece of matter to another; and, therefore, without having at all any original cause of its being, either within itself or from without: this, Dr. Clarke has proved to be a plain contradiction, and consequently, motion must of necessity be originally caused by something that is intelligent, or else there never could have been any such thing as motion in the world; and, therefore, the self-existent being, the original cause of all things, must of necessity be an intelligent being. Hence it follows, that the material world cannot possibly be the original self-existent being. For since the self-existent being is intelligent, and the material world plainly is not so, it follows, that the material world cannot possibly be self-existent.

Agreeably to Spinoza's system, he is led to maintain that the supreme cause is a necessary agent, and, therefore, that no thing, or mode of existence of any thing, could possibly have been in any respect different from what it now actually is; because, he says, from an infinitely perfect nature, infinite things in infinite manners must needs proceed: if any thing could possibly be otherwise than it is, the will and nature of God must be supposed capable of change; and if all possible things in all possible manners do not always and necessarily exist, they never can all exist, but some things that do not exist, will still always be possible only, and never can actually exist; and so the actual omnipotence of God is taken away. To this reasoning Dr. Clarke replies, that the first argument is a plain begging of the question; for, that an infinitely perfect nature is able indeed to produce infinite things in infinite manners, is certainly true; but that it must always actually do so, by an absolute necessity of nature, without any power of choice, either as to time, or manner, or circumstances, does by no means follow from the perfection of its nature, unless it be first supposed to be

be a necessary agent, which is the very question begged that was to be proved.

The second argument, he says, is, if possible, still weaker; for, how does it follow, if God, according to his eternal unerring purpose and infinite wisdom, produces different things at different times, and in different manners, that, therefore, the will and nature of God are changeable? It might exactly as well be argued, that if God (according to Spinoza's supposition) does always necessarily produce all possible differences and varieties of things; therefore his will and nature are always necessarily infinitely various, unequal, and dissimilar to themselves.

And as to the third argument, it is just such reasoning as if a man should argue, that if all possible eternal duration be not always actually exhausted, it can never be all exhausted; and that, therefore, so the eternity of God is taken away: a mode of arguing, the weakness of which must be discerned by every one at first sight. Besides, the assertion itself, that no thing, or mode of existence of any thing, could possibly have been made in any respect different from what it is, is so palpably absurd and false, so contradictory to experience and the nature of things, and to the most obvious and common reason of mankind, that of itself it immediately, and upon the first hearing, sufficiently confutes any principle of which it is a consequence. For all things in the world appear plainly to be the most arbitrary that can be imagined, and to be wholly the effects not of an absolute necessity of nature, but merely of a necessity of fitness, or of wisdom and choice. Moreover, Spinoza maintaining that the supreme cause is a necessary agent, is constrained to expose all final causes as the fictions of ignorant and superstitious men; and so laugh at those who are so foolish and childish as to fancy, that eyes were designed and fitted to see with, teeth to chew with, food to be eaten for nourishment, the sun to give light, &c. a mode of arguing to which reply is needless. See the article *God*.

Against Spinoza's system it is alleged by Mr. Bayle, 1. That it is impossible the universe should be but one substance, since every thing that is extended must necessarily have parts, and what has parts must be compounded. And as the parts of extension do not subsist in each other, it follows either that extension in the general is not substance, or that every part of extension is a different substance. Now, according to Spinoza, extension in general is an attribute of substance. And he allows, with other philosophers, that the attributes of substance do not differ really from the substance itself. He must, therefore, allow, that extension in general is substance; whence it will follow, that every part of extension is a particular substance; which overturns the whole system.

2. If it be absurd to make God extended, as this robs him of his simplicity, and makes him be composed of parts, it is still worse to reduce him to the condition of matter, the lowest of all beings, and that which most of the ancient philosophers ranked immediately above nothing; matter, the theatre of all sorts of changes, the field of battle of contrary causes, the subject of all corruptions and generations; in a word, the being, of all others, most incompatible with the immutability of the Deity.

The Spinozists, indeed, maintain, that it is not susceptible of any division; but the argument they allege in proof of it we have elsewhere shewn to be false: it is, that for matter to be divided, it is necessary that one of the parts be separated from the other by a void space, which is impossible; since, they say, there is no vacuum in nature. See *VACUUM*.

3. If Spinozism appear extravagant, when we consider

God as the subject of all the mutations, corruptions, and generations, in bodies, it will be found still worse, when we consider him as the subject of all the modifications of thinking. It is no small difficulty to unite extension and thinking in the same substance; since it is not an union like that of two metals, or of water and wine, that will serve the purpose: these last require only juxtaposition; whereas to combine thinking and extension, requires an identity. Thinking and extended are two attributes identified with the substance, and, consequently, they are identified with each other by the fundamental rule of all logic.

Again, when we say, that a man *denies this, affirms that, likes that, &c.* we make all those attributes fall on the substance of his mind, not on his thoughts, which are only accidents or modifications of it: if, therefore, what Spinoza advances be true, that men are modalities of God, it would be false to say, *Peter denies, likes, wills, &c.*; since, in reality, on this system it is, that God denies, wills, &c.; and, consequently, all the denominations which arise from the thoughts, desires, &c. of men, fall properly and physically on the substance of God. From whence it also follows, that God affirms and denies, loves and hates, wills and wills the same thing, at the same time, and under the same conditions; contrary to the great principle of reasoning, *opposita sunt quæ se neque de se invicem, neque de eodem tertio secundum idem, ad idem, eodem modo atque tempore verè affirmari possunt*; which must be false, if Spinozism be true; since it cannot be denied, but some men love and affirm what others hate and deny, under all the conditions expressed in the rule.

4. But if it be physically absurd to say, the same subject is modified at the same time with all the different thoughts of all men; it is horrible when we consider it in a moral light; since it will follow, that the infinite, the all-perfect Being, is not constant, is not the same one moment, but is eternally possessed even with contrary passions: all the uniformity in him in this respect, will be, that for one good and wise thought, he will have twenty foolish and wicked ones. He will not only be the efficient cause of all the errors, iniquities, and impurities of men, but also the passive subject of them, the *subjectum inhesionis*. He must be united with them in the closest manner that can be conceived, even by a penetrative union, or rather an identity, since the mode is not really distinct from the substance modified. Bayle, art. *Spinoza*.

SPINSTER, in *Law*, an addition usually given to all unmarried women, from the viscount's daughter downwards.

Yet Sir Edward Coke says, *generosa* is a good addition for a gentlewoman; and that, if such a person be named spinster in any original writ, appeal, or instrument, she may abate and quash the same.

Spelman says, that anciently, even queens used the distaff and spindle; whence spinster became a common appellation for all women.

SPINT, in *Commerce*, a corn measure of Germany. At Bremen, a last of corn, pease, or beans, contains 4 quarters, 40 scheffels, 160 viertels, or 640 spints; 50 scheffels answering to 101 bushels, Winchester measure. At Hamburg, a last of wheat or rye contains 3 wispels, 30 scheffels, 60 fasses, 120 kimterns, or 480 spints; and according to the standard measure of the fass, which is $21\frac{1}{2}$ inches in diameter, and $10\frac{1}{2}$ inches deep, Hamburg measure, its contents are 3872 Hamburg cubic inches, or 3213 English inches, 1 scheffel or two fasses = 3 bushels, Winchester measure nearly; and 1 last of Hamburg = $89\frac{1}{2}$ English bushels, or $11\frac{1}{3}$ English quarters.

SPINTHER, among the Romans, a kind of bracelet which the women, in the first ages of Rome, used to wear on the upper part of their left arm.

SPINTHERA, in *Mineralogy*, a mineral of greenish colour, which occurs crystallized in irregular dodecahedrons, composed of a double four-sided pyramid, obliquely truncated at the apexes. The crystals are small, and brightly shining; the fracture is lamellar. Its hardness is inferior to that of glass; it is translucent on the edges. It melts before the blowpipe without much difficulty. It has not been analysed. It was discovered by Haüy implanted in calcareous spar from Dauphiné. Aikin's Dict.

SPINUS, in the *Natural History of the Ancients*, the name of a fossil body of a very remarkable quality; for, according to the accounts of Theophrastus, and other authors of the greatest credit, it broke to pieces, and thrown in a heap exposed to the sun, it took fire and burnt, and that the more if moistened or sprinkled with water.

It seems to have been a substance nearly allied to what they call the *lapis thracicus*, but with this remarkable quality, both of them seem to have been of the class of the harder bitumens, and are wholly unknown to us. Some late writers have imagined, that the common black slate-stone, so frequent with us in the coal-pits, was the substance called by Theophrastus, and the ancients, by this name; but it had none of the qualities attributed to the spinus. Hill's Theophrastus, p. 35.

SPINUS, in *Ichthyology*, a species of the sparus, with a bifid tail, and the dorsal spine recumbent. It is found in the Indian seas.

SPINUS, the *Fringilla spinus* of Linnæus, in *Ornithology*, the name of a small bird, called by some *ligurinus*, and in English the *fskin*. Its head is black, and its neck and back green; the neck, however, has some slight admixture of a blackish tinge, and the roots of the back feathers have also some blackishness; its rump is of a greenish-yellow, as are also its breast and throat; its belly is white, and its tail is yellow underneath, with some brownish spots; the female is paler coloured than the male; and its throat, and its sides, under the wings, are whitish, with streaks of brown; the head and back are of a greenish ash-colour, marked with brown. It is common in Germany and England, which it visits at uncertain times, and is kept in cages for singing. In winter these birds fly in large flocks. In Suffex it is called the barley-bird, because it comes to them in the barley-feed time.

SPIO, in *Natural History*, a genus of the class Vermes, and order Mollusca. The generic character is as follows: Body projecting from a tube, jointed, and furnished with dorsal fibres; peduncles or feet rough with bristles, and placed towards the back; two feelers, which are long and simple; it has two oblong eyes. There are only two

Species.

* **SETICORNIS**. Feelers thin and striate. This species inhabits the ocean, principally where there is a clayey bottom; it is about three inches long; the tube is composed of agglutinated particles of earth, thin, erect, and thrice as long as the body. From this the animal projects its capillary white feelers in search of food, which consists of small marine worms; the body is whitish, with a tinge of green, with a red line down the middle of the back; the hind-part is of a sea-green; the fore-part is blackish-grey, with transverse white stræ; the head is pale.

FILICORNIS. Feelers thick and annulate. It inhabits the sea-shores about Greenland, and is an inch long. Body oblong, yellowish or reddish, with a cinereous line in the

middle, and at each end; the tube is fragile, erect, and greenish, from which it projects its feelers in search of *planaria*, and other small marine worms.

SPIPOLA, in *Ornithology*, the name of a small bird of the lark kind, of which there are, according to Aldrovand, three species, suspected by Mr. Ray to be only varieties of the *spinoletta*, or *tordino* of the Venetians.

Linnaeus makes two of these distinct species, under the titles of *alauda trivialis*, and *alauda pratensis*; the last of which is our tit-lark.

SPIRACLE. See **VENT**.

SPIRACULA, in the *History of Insects*, are little holes or pores placed singly on each side of every segment of the abdomen, through which the insect breathes; and if oil be applied so as to stop them up, it proves fatal to most of them.

SPIRÆA, in *Botany*, a name borrowed from Theophrastus, whose *σπιραία* is supposed to be one of the species of this pretty genus.—Linn. Gen. 253. Schreb. 341. Willd. Sp. Pl. v. 2. 1055. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 535. Ait. Hort. Kew. v. 3. 254. Pursh 341. Juss. 339. Lamarck Illustr. t. 439. Gærtn. t. 69.—Class and order, *Icosandria Pentagynia*. Nat. Ord. *Pomaceæ*, Linn. *Rosaceæ*, Juss.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, flat at the base, in five acute segments, permanent. *Cor.* Petals five, roundish-oblong, inserted into the calyx. *Stam.* Filaments more than twenty, thread-shaped, inserted into the calyx, shorter than the corolla; anthers roundish. *Pistl.* Germens five or more; styles as many, thread-shaped, the length of the stamens; stigmas capitate. *Peric.* Capsules oblong, compressed, pointed, each of one cell and two valves. *Seeds* few, pointed, small, inserted into the inner margins of the valves.

Obf. *S. Filipendula* and *Ulmaria* have numerous germens and capsules; *S. Aruncus* is dioecious; *S. opulifolia* has only three germens and styles.

Ess. Ch. Calyx five-cleft. Petals five. Capsules superior, of two valves, with several seeds.

Seet. 1. *Stem shrubby.*

1. *S. laevigata*. Smooth-leaved Spiræa. Linn. Mant. 244. Willd. n. 1. Ait. n. 1. (*S. altaica*; Pall. Ross. v. 1. p. 1. 37. t. 23.)—Leaves obovato-lanceolate, entire, sessile, smooth. Clusters stalked, corymbose.—Native of Siberia. The English gardens are obliged to Dr. Solander for this shrub, which is quite hardy, flowering copiously in summer, and distinguished by its very smooth, willow-like, rather glaucous leaves. *Flowers* pure white, in clusters, collected into corymbose tufts at the ends of the branches. The leaves are deciduous in all the species.

2. *S. salicifolia*. Willow-leaved Spiræa. Linn. Sp. Pl. 700. Fl. Brit. n. 1. Engl. Bot. t. 1468. Ait. n. 2. Pursh n. 1. Pall. Ross. v. 1. p. 1. 36. t. 21, 22. (*S. Theophrasti fortè*; Ger. Em. 1601.)—Leaves ovato-lanceolate, bluntish, serrated, smooth. Clusters terminal, compound.—Native of mountain thickets, near water, in Siberia, Tartary, and North America, as well as in Scotland and the north of England. It is common in shrubberies, flowering in July. The stem is four or five feet high, erect, bushy. Leaves stalked, from one to two inches long, various in breadth, deeply serrated. *Flowers* pink, with a dark red calyx. In America there is a white variety.

3. *S. callosa*. Callous Spiræa. Thunb. Jap. 209. Willd. n. 3. (*S. japonica*; Linn. Suppl. 262.)—Leaves lanceolate, acute, serrated, rather villous. Stem downy. Panicle doubly compound, somewhat level-topped.—Native of Japan, flowering in June. Leaves longer and more acute than

than in the last, more villous than in the following, and not downy. The paniced *inflorescence* distinguishes it from both. *Flowers* red, on villous stalks.

4. *S. tomentosa*. Scarlet Spiræa. Linn. Sp. Pl. 701. Ait. n. 3. Pursh n. 2. "Schmidt Arb. v. 1. 52. t. 51." (*Ulmaria pentacarpos*, &c.; Pluk. Phyt. t. 321. f. 5.)—Leaves ovate, unequally ferrated; downy and white beneath. Clusters compound, downy.—Native of North America; a hardy shrub in our gardens, flowering towards autumn, and justly admired for its bright red *flowers*, and the white downiness of the backs of its *leaves*. In other respects it much resembles *S. salicifolia*.

5. *S. argentea*. Silvery Spiræa. Linn. Suppl. 261. Willd. n. 5.—Leaves wedge-shaped, furrowed, somewhat plaited; silky on both sides; ferrated at the extremity. Clusters compound. Capsules fringed.—Sent from New Granada by Mutis to Linnæus. The copious silvery *leaves*, about an inch long, render this a very elegant shrub. The *clusters* are numerous at the ends of the branches, but do not consist of many *flowers*. The *germens* and *capsules* are bordered with long hairs.

6. *S. alpina*. Alpine Small-leaved Spiræa. Pall. Roff. v. 1. p. 1. 35. t. 20. Willd. n. 6.—Leaves linear-lanceolate, partly toothed, very smooth. Flowers corymbose.—Native of cold woody mountains in Siberia, near the lake Baical. A small, spreading, branching *shrub*, whose bark splits into long threads. The *leaves* are hardly an inch long, and very narrow. *Flowers* white, in small downy *corymbs*, solitary at the end of each branch.

7. *S. hypericifolia*. St. John's-wort Spiræa, or Italian May; commonly called *Hypericum frutex*. Linn. Sp. Pl. 701. Ait. n. 4. Pursh n. 3. "Schmidt Arb. v. 1. 55. t. 56." Bocc. Mus. 137. t. 96. (*Pruno sylveltri affinis canadensis*; Pluk. Phyt. t. 218. f. 5.)—Leaves obovate, entire. Umbels sessile.—In dry swamps of Canada and New York, flowering in May. *Pursh*. This shrub, cultivated for near 200 years past in our English gardens, and asserted to be of American origin, is no less apparently wild on all the hills of Umbria, between Terni and Trevi, as Boccone long ago mentioned. (See Sm. Tour, ed. 2. v. 2. 322.) It is frequently called in England Italian May. The *leaves* are an inch long, resembling some species of *Hypericum*. *Flowers* white, copious and very pretty, in smooth lateral umbels.

8. *S. chamædrifolia*. Germander-leaved Spiræa. Linn. Sp. Pl. 701. Ait. n. 5. Pursh n. 4. Pall. Roff. v. 1. p. 1. 32. t. 15.—Leaves obovate, smooth, cut, and ferrated. *Corymbs* stalked.—Native of Siberia and Hungary. Hardy with us, flowering in June and July. The *leaves* are green, or slightly glaucous, on both sides, an inch, or rather more, in length. *Flowers* white, rather bigger than the last, nearly umbellate. *Branches* angular.

9. *S. ulmifolia*. Elm-leaved Spiræa. Scop. Carn. v. 1. 349. t. 22*. Willd. n. 9. Ait. n. 6. (*S. chamædrifolia*; Jacq. Hort. Vind. v. 2. 66. t. 140.)—Leaves ovate, smooth, doubly ferrated; glaucous beneath. *Corymbs* racemose, elongated, on long stalks.—Native of Carniola and Siberia. Cultivated for about 30 years past in our gardens, flowering in June. A shrub larger in all its parts than the foregoing, especially the *flowers*, which are rather racemose than corymbose. The *leaves* are an inch and a half long, on stalks one-third that length.

10. *S. betulifolia*. Birch-leaved Spiræa. Pall. Roff. v. 1. p. 1. 33. t. 16. Pursh n. 5.—Leaves broadly ovate, smooth, deeply ferrated, on short stalks. *Corymbs* compound, level-topped.—Native of Siberia; and, according to Mr. Pursh, of the mountains of Virginia, flowering from

May to July. He describes it as not above a foot high; the *flowers* tinged with red, and asserts it to be very distinct from the last, to which Willdenow refers Pallas's synonym. The *leaves* appear to be much broader than in the *ulmifolia*, with shorter thicker *footstalks*, and the *inflorescence* more compact.

11. *S. crenata*. Hawthorn-leaved Spiræa. Linn. Sp. Pl. 701. Ait. n. 7. Pall. Roff. v. 1. p. 1. 35. t. 19. (*Oxyacantha angustifolia non spinosa*; Barrel. Ic. t. 564.)—Leaves obovate, acute; toothed at the extremity. *Corymbs* lateral, crowded, stalked.—Native of Siberia, Tartary, Hungary, and Spain. Cultivated by Miller in 1739, and frequently met with in curious shrubberies, flowering in May. The *leaves* vary much in size and shape, but are always strongly toothed, or jagged, at the end. When small they are often three-ribbed, but that character is not so constant as to make a specific difference. *Flowers* white, in copious, short, lateral, leafless clusters. Willdenow suspects the Spanish variety may be a distinct species, but we find our garden plant so variable, that the line of distinction is scarcely to be drawn. A comparison of living specimens must decide the question.

12. *S. trilobata*. Three-lobed Spiræa. Linn. Mant. 2. 244. Willd. n. 11. Ait. n. 8. Pall. Roff. v. 1. p. 1. t. 17.—Leaves roundish, somewhat heart-shaped, bluntly lobed, toothed. Umbels terminal.—Native of mountains in Siberia. A hardy shrub with us, introduced by sir J. Banks in 1801, but not yet come into general culture. It flowers in May. The *leaves* are smooth, not unlike those of a gooseberry in shape. *Flowers* white, copious, and handsome.

13. *S. thalictroides*. Meadow-rue-leaved Spiræa. Willd. n. 12. Ait. n. 9. Pall. Roff. v. 1. p. 1. 34. t. 18.—Leaves obovate, obtuse, somewhat three-lobed. Umbels lateral, sessile.—Native of the alps of Dauria. Flowering at Kew in May. A pretty species, with small *leaves*, very glaucous beneath. *Flowers* white, smaller than the last, and lateral, not terminal.

14. *S. opulifolia*. Virginian Guelder-rose. Linn. Sp. Pl. 702. Ait. n. 10. Pursh n. 6. "Schmidt Arb. v. 1. 52. t. 52." (*Euonymus virginiana, ribesii folio, capsulis eleganter bullatis*; Comm. Hort. v. 1. 169. t. 87.)—Leaves ovate, three-lobed, ferrated, smooth. *Corymbs* terminal, dense, bracteated. Capsules polished, inflated.—On the banks of rivers, particularly among the mountains, from Canada to Carolina, flowering in June and July. Generally known by the name of Nine-bark. *Pursh*. Cultivated by bishop Compton, and now common in shrubberies, forming a small tree, with much resemblance to the Common Guelder-rose. *Flowers* white, somewhat like Hawthorn. *Capsules* tumid, smooth, of a shining brown. *Calyx* more or less downy.

15. *S. capitata*. Capitata Spiræa. Pursh n. 7.—"Leaves ovate, somewhat lobed, doubly toothed; reticulated and downy beneath. *Corymbs* terminal, dense, somewhat capitate, on very long stalks. *Calyx* downy."—Found by Mr. Menzies, on the north-west coast of America, flowering in June. Gathered also on the Columbia river by governor Lewis. *Pursh*.

16. *S. ariæfolia*. Beam-tree-leaved Spiræa.—Leaves elliptic-oblong, somewhat lobed, toothed; pale and villous beneath. Clusters compound, paniced, terminal, downy.—Gathered on the north-west coast of America, by Mr. Menzies, to whom we are obliged for specimens. It seems not noticed by Mr. Pursh. Perhaps this species ought, on account of its paniced very compound *inflorescence*, to be ranged near *salicifolia* and *tomentosa*. The *leaves* are lobed like

SPIRÆA.

like *Pyrus Aria*, but rather smaller, and villous, not cottony, beneath. The dried *flowers* look as if they had been reddish.

17. *S. difcolor*. Folded-leaved Spiræa. Pursh n. 8.—“Leaves ovate, lobed, toothed, somewhat plaited; snow-white and downy beneath. Panicles terminal, stalked, very much branched.”—On the banks of the Kookkooksky, gathered by governor Lewis, flowering in June and July. A shrub about five feet high. *Pursh*. Can this be the same species with our last? We have not had an opportunity of comparing specimens.

18. *S. forbifolia*. Service-tree-leaved Spiræa. Linn. Sp. Pl. 702. Ait. n. 11. Pursh n. 9. Pall. Ross. v. 1. p. 1. 34. t. 24, 25. (S. n. 51; Gmel. Sib. v. 3. 190. t. 40.)—Leaves pinnate; leaflets uniform, sharply serrated. Stem shrubby. Flowers paniced.—Native of Siberia and the north-west coast of America, flowering in July and August. Frequent in gardens, and distinguished by the elegance of its bright-green, finely serrated *leaves*, as well as its large panicles of cream-coloured *flowers*. The *root* creeps in some degree. The *stems* are three or four feet high, not very woody.

SECT. 2. *Stem herbaceous*.

19. *S. Aruncus*. Goat's-beard Spiræa. Linn. Sp. Pl. 702. Ait. n. 12. Pursh n. 10. Pall. Ross. v. 1. p. 1. 39. t. 26. (*Barba capri*; Fuchf. Hist. 181. B. capræ; Camer. Hort. 26. t. 9.)—Leaves doubly compound. Spikes paniced. Flowers dioecious.—Native of Siberia, Austria, Switzerland, the Pyrenées, and the mountains of North America. A hardy perennial in our gardens, of great elegance, about a yard high, with ample light-green *leaves*, and innumerable white feathery *flowers*, produced in June and July.

20. *S. Filipendula*. Common Dropwort Spiræa. Linn. Sp. Pl. 702. Willd. n. 16. Fl. Brit. n. 2. Engl. Bot. t. 284. Fl. Dan. t. 635. (*Filipendula*; Ger. Em. 1058. Camer. Epit. 608. Matth. Valgr. v. 2. 217.)—Leaves interruptedly pinnate; leaflets uniform, serrated, smooth. Stem herbaceous. Flowers cymose, with many styles.—Native of high chalky or gravelly pastures in England, and other parts of Europe, flowering in July. Commonly double in gardens. The *root* is perennial, furnished with oval woody knobs. *Stem* one or two feet high. *Leaflets* small, oblong, sharply cut. *Flowers* cream-coloured, with here and there a tinge of red.

21. *S. Ulmaria*. Meadow-sweet Spiræa. Linn. Sp. Pl. 702. Willd. n. 17. Fl. Brit. n. 3. Engl. Bot. t. 960. Curt. Lond. fasc. 5. t. 33. Fl. Dan. t. 547. (*Regina prati*; Ger. Em. 1043.)—Leaves interruptedly pinnate; downy beneath: the terminal leaflet lobed. Flowers cymose, with many styles.—Common in wet meadows, bogs, and the borders of rivers and pools throughout Europe, flowering in June and July. The *root* is fibrous, perennial. *Stems* three or four feet high. *Leaves* broad, serrated; white underneath. *Flowers* cream-coloured, copious, with a very sweet, but oppressive, fragrance. *Germs* twisted.

22. *S. digitata*. Fingered Spiræa. Willd. n. 18. (*S. palmata*; Linn. Suppl. 262. Pall. Ross. v. 1. p. 1. 40. t. 27.)—Leaves pinnate; downy beneath: the terminal leaflet largest, in seven deep lobes; side ones in five. Corymb compound, dense.—Native of moist mountainous situations, in the eastern part of Siberia. This has the habit of the last, but the palmate deeply divided *leaflets* abundantly distinguish it.

23. *S. lobata*. Palmate Red Spiræa. Jacq. Hort. Vind. v. 1. 38. t. 88. Willd. n. 19. Pursh n. 11.—Leaves pin-

nate, smooth: the terminal leaflet largest, seven-lobed: side ones three-lobed. Corymbs proliferous.—In fertile wet meadows of Virginia and Carolina, flowering in July and August. A beautiful perennial; *flowers* red, in large clusters. *Pursh*. The Linnæan herbarium shews that authors have here misapplied the reference to the *Supplementum*, which belongs to the last species.

24. *S. camtschatica*. Broad-leaved Siberian Spiræa. Pall. Ross. v. 1. p. 1. 41. t. 28. Willd. n. 20.—Leaves five-lobed, with auricles on the stalks. Corymbs proliferous. Stem somewhat hairy.—Native of Camtschatka and Beering's island. The *root* is perennial. *Leaves* very broad, smooth, with acute lobes. *Flowers* white.

25. *S. palmata*. Palmate Japan Spiræa. Thunb. Jap. 212. Willd. n. 21.—“Leaves palmate, serrated. Panicle repeatedly compound. Stem smooth.”—Native of Japan. The stalks of the *leaves* seem to have no auricles, and the *stem* is smooth; otherwise the description of this species bears some resemblance to the last. *Flowers* red or white.

26. *S. trifoliata*. Common Three-leaved Spiræa. Linn. Sp. Pl. 702. Ait. n. 16. Pursh n. 12. Curt. Mag. t. 489.—Leaves ternate, serrated, nearly equal. Stipulas linear. Flowers terminal, loosely paniced. Calyx tubular.—In shady woods and on bogs, chiefly in the mountainous parts of North America from Canada to Florida, flowering in June and July. *Pursh*. A hardy perennial in our gardens, of singular elegance, with large drooping *flowers*, whose *petals* are white, *calyx* deep red.

27. *S. stipulacea*. Auricled Three-leaved Spiræa. Willd. Enum. 542. Pursh n. 13.—Leaves ternate, serrated, nearly equal. Stipulas ovate, leafy, cut. Flowers terminal, loosely paniced. Calyx bell-shaped.—In the shady woods of Kentucky and Tennessee, flowering in June and July. *Pursh*. We received it from the choice garden of James Vere, esq. in August, 1814. The general appearance of this species is very like the last, but the very large *stipulas*, and perhaps the shorter greener *calyx*, distinguish it.

SPIRÆA, in *Gardening*, contains plants of the shrubby and herbaceous kinds, among which the species cultivated are, the willow-leaved spiræa (*S. falcifolia*); the scarlet-leaved spiræa (*S. tomentosa*); the hypericum-leaved spiræa (*S. hypericifolia*); the silver-leaved spiræa (*S. argentea*); the germander-leaved spiræa (*S. chamædrifolia*); the hawthorn-leaved spiræa (*S. crenata*); the three-lobe-leaved spiræa (*S. triloba*); the currant-leaved spiræa (*S. opulifolia*); the service-leaved spiræa (*S. forbifolia*); the goat's-beard spiræa (*S. aruncus*); the common dropwort spiræa (*S. filipendula*); the common meadow-sweet spiræa (*S. ulmaria*); and the three-leaved spiræa (*S. trifoliata*).

In the first species there are several varieties; as the flesh-coloured willow-leaved, the Alpine willow-leaved, the paniced willow-leaved, and the broad willow-leaved spirææ. The tough, straight, pliant, young shoots of this plant are sometimes used to top fishing-rods, &c.

The fifth species varies very much, with larger or smaller leaves, more or less cut, but more commonly quite entire and ovate-acute.

The eighth sort is commonly known in the nurseries by the name of Virginian guelder rose.

The eleventh sort is an elegant plant, which in gardens grows very luxuriantly, and has often double flowers.

In the twelfth sort there are varieties with double flowers, and with variegated leaves.

Method of Culture.—In all the shrubby sorts, this may be performed by suckers, layers, and cuttings. The suckers should be taken off in the autumn, and planted out where they are to remain, or in nursery-rows, to attain a

fuller growth. The first fort requires to be cleared of these suckers every two years at farthest. The layers should be put down in the autumn, or in the spring, and may be taken off and planted as above, in the autumn or spring following. All the forts may be raised in this way; but it is most proper for such forts as do not fend off suckers. The cuttings may be made from the shoots of the preceding summer, and be planted out in a shady border, in the early autumn. When they have become well rooted, they may be removed, and managed as the others. They succeed in this way with more difficulty than in either of the others.

All the herbaceous forts may be increased by seeds, or parting the roots. The seed may be sown in the autumn, or early in the spring, but the first is the better mode, on a bed of fine mould. When the plants appear, they should be kept clear from weeds till the autumn, when they may be planted where they are to remain, or in the nursery for a year or two. The roots should be parted in the autumn or spring, when the stems decay, before they shoot out new ones, being planted immediately where they are to grow. The double-flowered and striped varieties can only be preferred in this way.

They all afford variety and ornament in the shrubbery, and other parts of pleasure-grounds.

SPIRÆA, African, in *Botany*. See *DIOSMA*.

SPIRAL, in *Geometry*, a curve line of the circular kind, which, in its progress, recedes from its centre; as in winding from the vertex, down to the base of a cone.

It is called, from its inventor, *Archimedes's spire*, or *helix*, and is thus described: divide the periphery of a circle $A p A$ (*Plate XIV. Geometry, fig. 4.*) into any number of equal parts, by a continual bisection in the points p . Into the same number of parts divide the radius CA , and make CM equal to one part, Cm to two parts, &c. Then will the points, M, m, m , &c. be points in the spiral; which, connected, will give the spiral itself.

This is more particularly called the *first spiral*; and the space included between its centre and the point A , the *spiral space*.

The first spiral may be continued to a *second spiral*, by describing another circle with double the radius of the first; and the second may be continued to a *third*, by a third circle, &c.

Hence, 1. $A p$ is to the periphery, as Cm to the radius: wherefore, if the periphery be called p , the radius $AC = r$, $A p = x$, $p m = y$; then will $Cm = r - y$: consequently, as $p : r :: x : r - y$, we shall have $p r - p y = r x$.

2. If $Cm = y$, then will $r x = p y$; which equation the spiral has in common with the quadratrix of Dinostrates, and that of Tschirnhausen: and, therefore, $r^n x^m = p^n y^m$ will serve for infinite spirals and quadratrices. See *QUADRATRIX*.

The spiral line may be conceived to be thus generated: If a right line, as AB (*Plate XIV. Geometry, fig. 5.*) having one end fixed at B , be equally moved round, so as, with the other end A , to describe the periphery of a circle; and, at the same time, a point be conceived to move forward equally, from B towards A , in the right line AB , so as that the point describes that line, while the line generates the circle; then will the point, with its two motions, describe the curve $B, 1, 2, 3, 4, 5$, &c. which is called a spiral line; and the plain space contained between the spiral line and the right line BA , is called the spiral space.

Again, if the point B be conceived to move twice as slow as the line AB , so that it shall get but half way along BA , when that line shall have formed the circle; and if then you imagine a new revolution to be made of the line carrying the

point, so that they shall end their motion at last together, there will be formed a double spiral line, as in the figure: from the manner of which may be easily drawn these corollaries:

1. That the lines $B 12, B 11, B 10$, &c. making equal angles with the first and second spiral (as also $B 12, B 10, B 8$, &c.) are in arithmetical proportion.

2. The lines $B 7, B 10$, &c. drawn any how to the first spiral, are to one another as the arcs of the circle intercepted betwixt BA and those lines; because, whatever parts of the circumference the point A describes, as suppose 7 , the point B will also have run over 7 parts of the line AB .

3. Any lines drawn from B to the second spiral, as $B 18, B 22$, &c. are to each other as the aforesaid arcs, together with the whole periphery added on both sides: for at the same time that the point A runs over 12 , or the whole periphery, or perhaps 7 parts more, shall the point B have run over 12 , and 7 parts of the line AB , which is now supposed to be divided into 24 equal parts.

The area $CABDE$ of the spiral of Archimedes (*Plate XIV. Geometry, fig. 6.*) is equal to one-third part of the circle, described with the radius CE .

In like manner, the whole spiral area, generated by the ray drawn from the point C to the curve, when it makes two revolutions, is the third part of a space double of the circle described with the radius $2CD$; and the whole area, generated by the ray from the beginning of the motion, till after any number of revolutions, is equal to the third part of a space that is the same multiple of the circle described with the greatest ray, as the number of revolutions is of unit.

Any portion of the area of the spiral, terminated by the curve $Cm A$, and the right line CA , is equal to one-third of the sector CAG , terminated by the right lines CA and CG , the situation of the revolving ray, when the point that describes the curve sets out from C . See Maclaurin's Fluxions, Introd. p. 30, 31. See *QUADRATURE of the Spiral of Archimedes*.

SPIRAL, Logistic, or Logarithmic. See *LOGISTIC* and *QUADRATURE*.

SPIRAL of Pappus, a spiral formed on the surface of a sphere, by a motion analogous to that by which the spiral of Archimedes is described in plano.

This spiral is so called from its inventor Pappus. *Collect. Mathem. lib. ii. prop. 30.*

Thus, if C be the centre of the sphere (*fig. 7.*), $ARBA$ a great circle, P its pole; and while the quadrant PMA revolves about the pole P with an uniform motion, if a point proceeding from P move with a given velocity along the quadrant, it will trace upon the spherical surface the spiral PFa .

Now if we suppose the quadrant PMA to make a complete revolution in the same time that the point, which traces the spiral on the surface of the sphere, describes the quadrant, which is the case considered by Pappus; then the portion of the spherical surface terminated by the whole spiral, the circle $ARBA$, and the quadrant PMA , will be equal to the square of AB . In any other case, the area $PMA a FZP$ is to the square of the diameter AB , in the same proportion as the arc Aa is to the whole circumference $ARBA$. And this area is always to the spherical triangle PAa , as the inscribed square is to the circle. See Maclaurin's Fluxions, Introd. p. 31—33.

The portion of the spherical surface, terminated by the quadrant PMA , the arcs AR, FR , and the spiral PZF , admits of a perfect quadrature, when the ratio of the arc Aa to

As to the whole circumference can be assigned. See Mac-laurin, *ibid.* p. 33.

SPIRAL, Parabolic. See HELICOID.

SPIRAL, Proportional, is generated by supposing the radius to revolve equably, and a point from the circumference to move towards the centre with a motion decreasing in a geometric progression. See LOGISTIC.

From the nature of a decreasing geometric progression, it is easy to conceive that the radius CA (*fig. 8.*) may be continually divided; and although each successive division becomes shorter than the next preceding one, yet there must be an indefinite number of divisions or terms before the last of them becomes of no finite magnitude. Whence it follows, that this spiral winds continually round the centre, and does not fall into it till after an indefinite number of revolutions: and also that the number of revolutions decreases, or the number of the equal parts into which the circumference is divided increases.

It is also evident, that any proportional spiral cuts the intercepted radii at equal angles: for, if the divisions A d, d e, e f, f g, &c. of the circumference be very small, the several radii would be so close to one another, that the intercepted parts AD, DE, EF, FG, &c. of the spiral might be taken as right lines; and the triangles CAD, CDE, CEF, &c. would be similar, having equal angles at the point C. and the sides about those angles proportional: consequently, the angles at A, D, E, F, &c. being equal, the spiral must necessarily cut the radii at equal angles. Robertson's *Elem. of Nav.* book ii. p. 87.

Proportional spirals are such spiral lines as the rhumb lines on the terrestrial globe, which, because they make equal angles with every meridian, must also make equal angles with the meridians in the stereographic projection on the plane of the equator, and therefore will be, as Dr. Halley observes, proportional spirals about the polar point. From whence he demonstrates, that the meridian line is a scale of log. tangents of the half meridian complements of the latitudes. See RHUMB, LOXODROMY, and MERIDIONAL Parts.

SPIRAL, in Architecture and Sculpture, denotes a curve that ascends, winding about a cone, or spire, so that all the points of it continually approach the axis.

By this it is distinguished from the helix, which winds, after the same manner, around a cylinder. Ignorant architects confound the two, but the more knowing distinguish them carefully.

SPIRAL Pump. See ARCHIMEDES'S SCREW.

SPIRAL Stairs, in Building. See STAIRS.

SPIRAL Vessels, in Vegetable Physiology, are found ranged concentrically round the pith in the tender branches or stalks of numerous plants, particularly the Elder, Syriuga, Cornel, Peony, and many of the Liliaceous order. If a branch be partly cut transversely, or gently broken, and the portions slowly drawn asunder, a number of fine white fibres will be perceived gradually to unroll, and these will often support a considerable piece of the divided stalk. These fibres originally formed the coat of the vessels in question. After the plant has acquired a certain firmness of texture, or has finished its growth for the season, such can no longer be unrolled. Mirbel has delineated many specimens of these vessels, in which the spiral fibre of each is more or less imperfect, shewing that, probably as they advance in age, the vessels become entire tubes.

The use of these spiral-coated vessels has been much disputed. They being commonly found on dissection to contain scarcely any fluid but air, Malpighi, Crew, and others,

have called them air-vessels, supposing they were the lungs of plants, and imbibed air from the atmosphere, through another more external set of roundish or oval air-vessels, of which leaves, petals, &c. are full. But the experiments of Darwin and Knight rather shew the spiral-coated tubes to be the true sap-vessels, in which light we have considered them in the article CIRCULATION of Sap, to which we refer the reader. No such spiral vessels are found in the bark of plants, at any period of its growth.

SPIRATION. See EXPIRATION, INSPIRATION, PER-SPIRATION, RESPIRATION, and TRANSPIRATION.

SPIRATION, in Scholastic Theology, a term used by the popish schoolmen to signify the manner in which the personality of the Holy Spirit was derived from the Father and the Son. See PROCESSION and Holy SPIRIT.

SPIRDING SEE, in Geography, a large lake of Prussia; 30 miles S. of Bartenstein.

SPIRE, in Agriculture, a term signifying to sprout, as grain in the malting process, &c. The spiring in this process should neither be carried too far nor stopped too suddenly, as in both cases the malt suffers injury. See MALT.

SPIRE, Spira, in the Ancient Architecture, is sometimes used for the base of a column, and sometimes for the atragal, or tore.

The word is formed from the Latin *spira*, the folds of a serpent, which bear some resemblance to it; or from the Greek *σπῆρα*, the coil of a rope.

SPIRE is also a pyramidal termination of the tower of a church or other building. This ornament, being the genuine offspring of the pointed arch, and not occurring in the monuments of Greece or Rome, ought to be confined to its proper style. It is an incongruity to introduce it into Grecian architecture.

SPIRE, in Geography, a city of France, and principal place of a district, in the department of Mont Tonnerre, containing 3744 inhabitants, (its canton having 7894,) in 9 communes. This was, before the French revolution, an imperial city of Germany, and the capital of a bishopric of the same name. Spire is an ancient city, said to have been founded before the commencement of the Christian era, and receives its name from the small river Spirebach, which runs into the Rhine, about 500 paces below it. It contains a cathedral, three collegiate churches, and several convents, besides two churches belonging to the Lutherans, of which class the magistrates and greater number of the inhabitants consist. The Franks took this city from the Romans, and it became one of the original imperial cities. In the year 1529, a diet was held here, in which the reformers first obtained the name of Protestants. It was destroyed by the French in 1689, and lay waste for ten years, nor was it rebuilt till after the peace of Ryfwick. Before this disaster, it was the seat of the imperial chamber. In December 1793, it surrendered to the republican troops of France. The bishopric of Spire is of considerable antiquity. Its territories were situated on the Rhine, between the Palatinate, the duchy of Wurtemberg, the margraviate of Baden, and the principality of Deux-Ponts, about 18 leagues in length, and 12 in breadth. It is mountainous, and covered with forests; nevertheless it produces corn, wine, chestnuts, and almonds. The bishop was suffragan of Mentz, and resided at Bruchsal. The territories on the left bank of the Rhine have been united to France, and in 1802, those on the right were given as indemnities to the margrave of Baden; 12 miles S.W. of Heidelberg. N. lat. 49° 18'. E. long. 8° 30'.

SPIRES,

SPIRES, in *Rural Economy*, a term provincially used to signify timber-lands.

SPIRINCHUS, in *Ichthyology*, a name by which some authors have called the smelt.

SPIRIT, **SPIRITUS**, in *Physiology*, the most subtle and volatile part, or juice of the body; by means of which its functions and operations have been supposed to be performed.

The ancients made a fourfold division of spirits; into *vital*, *animal*, *natural*, and *genital*; the first of which they placed in the heart; the second, in the brain; the third, in the stomach and liver; and the last, in the testicles: but as this division is founded on a false hypothesis, it is now deservedly set aside.

The moderns have usually divided spirits into *vital* and *animal*: the former being only the finest and most agitated parts of the blood, on which its motion and heat depend: and the latter an exceedingly thin, subtle, moveable fluid, juice, or humour, separated from the blood in the cortex of the brain, and thence received into the minute fibres of the medulla, and by them discharged into the nerves; by which it is conveyed through every part of the body, to be the instrument of sensation, muscular motion, &c. See *ANIMAL Spirits*, and *NERVOUS Fluid, Juice, and System*.

SPIRITS, *Low*, in *Medicine*. See **MELANCHOLY**.

SPIRIT, *Spiritus*, in the *Newtonian Physics*, denotes a most subtle penetrative substance, which some have supposed to pervade all, even the densest bodies, and to lie hid in them; and by the force and action of which, the particles of bodies attract each other, at very small distances, and, when contiguous, cohere; and by which electrical bodies act at greater distances, both attracting and repelling the neighbouring corpuscles; and light is emitted, reflected, and inflected, and warms bodies; and all sensation is excited, and the members of the animals move at the instance of the will, *viz.* by vibrations of this spirit, propagated through the solid capillaments of the nerves, from the external organs of sense to the brain, and from the brain to the muscles.

SPIRIT, in *Antiquated Chemistry*, is one of the hypothetical principles of natural bodies, called also *mercury*.

The chemical principle spirit was defined to be a fine, subtle, volatile, penetrating, pungent liquor, which rises, ordinarily, before the phlegm, or water, and sometimes after it.

The great properties of this liquor were imagined to be, that it penetrates and opens solid bodies; corrodes, breaks, and even dissolves certain mixed bodies; coagulates others; and produces an infinity of other effects, many of them even contrary to one another.

In the general, the early chemists gave the denomination of spirits to all the fine, subtle, not aqueous, particles raised from bodies by heat, and reduced into liquors by distillation. Such are spirit of vitriol, of nitre, of salt, &c.

They also applied the name spirits to those aqueous liquors which are drawn by liquefaction, when they are impregnated with salts or other active principles, raised, together with them, by the violence of the fire.

In this sense, the chemists were said to draw a spirit from sulphur, salt, and other bodies, when they extract the essence, or the subtlest part of them, by distillation, or otherwise. Accordingly, spirits were distributed into three principal kinds, *viz.* *inflammable* spirits, *acid* spirits, and *alkaline* spirits.

To the first class belong the most volatile and thinnest part of essential oils, the principle of smell, or *spiritus rector* of

plants, (see **AROMA**,) and *ardent* spirits, or the spirit obtained from wine, beer, and all liquors which have undergone the spirituous fermentation. See **ALCOHOL**.

The second class includes all acids obtained by distillation of minerals, vegetables, and animals; such are, 1. The acids of sulphur, vitriol, and alum, which are the same as vitriolic acid, and the acids of nitre and common salt. They are called spirit of sulphur, spirit of vitriol, spirit of nitre, &c. without specifying that they are acids. 2. The acids of vinegar, and of all liquors which have undergone the acetous fermentation, and the acids obtained in the distillation of vegetables, and of certain animals, as flies, ants, &c. These spirits are commonly called *acid* spirits, as the acid spirit of guaiacum, the acid spirit of ants, &c. because the substances which furnish them yield also spirits that are not acid. See **ACID**.

To the third class are referred liquid volatile alkalies, obtained from sal ammoniac, from all vegetable matters which have undergone a complete putrefaction, and from all animal matters. These are generally called spirits, without specifying their alkaline quality. Thus we say, volatile spirit of sal ammoniac, spirit of hartshorn, &c. As some of these substances, particularly sal ammoniac, contain also an acid which may be obtained from them, we ought, when we mention this spirit, to specify its acid quality, calling it acid spirit of sal ammoniac.

SPIRITS, *Distilled*, a general name given among distillers to those ardent liquors that are obtained from various materials, and by different processes of distillation. The nature and properties of these liquors, and the modes of obtaining them, are detailed under the articles **ALCOHOL**, **BRANDY**, **DISTILLATION**, **FERMENTATION**, &c.; but we shall here specify some particulars that more immediately relate to the common spirituous liquors that are, we lament to say it, so much in use in our own country. These are, for the most part, prepared from fermented corn of one kind or other, with certain additions, at the pleasure of the distiller, of molasses, carrots, and other saccharine vegetables. The principal ingredient, except in a season of scarcity, is one kind or other of grain. (See **ADDITION**.) The spirit thus procured is rectified for sale by being redistilled with juniper-berries, turpentine, and other substances, in order to modify and improve its flavour and appearance. The grain, when barley is used, is usually first malted, and in Scotland it is dried with peat, which gives to the spirit distilled from it, called "whisky," its peculiar flavour. It is then ground into coarse powder, and the infusion fermented with yeast in large tuns. This fermented liquor is called "wash," and in this state it is fit for distillation. Under the articles already referred to, the general process and the implements used in it are described; but previously to the operation some substances are added to the wash, for the purpose either of increasing the quantity of spirit that is afforded by it, or of keeping down the essential oil derived from the malt, which would give the liquor a nauseous flavour, or of regulating the boiling within the still, and preventing it from boiling over or "running foul," or of neutralizing the acid generated during the fermentation, which would very considerably lessen the product of spirit. For these purposes soap is considered the best addition, and accordingly it is used in large quantities. Other distillers use alkalies. At the commencement of the operation, the liquid is oily and turbid, and has a nauseous flavour, on account of the oil of the malt which accompanies it; but by degrees it becomes clear, and runs so to the last, although its strength decreases, and it becomes more watery,

SPIRITS.

and consequently of less specific gravity. (See *Specific Gravity*.) The quantity intermediately obtained, omitting the first and the last products, is then redistilled or "rectified," (see *RECTIFICATION*); and in this stage of the operation, those additions (such as juniper-berries, &c.) which give the spirit its flavour, are introduced into it. The process of distillation on a small scale is simple and easily conducted; but the large distilleries, where expensive works are carried on, require a greater degree of practical skill, both in the preparation of the apparatus, the adjustment of the materials, and the conduct of the operation. In order to expedite the process, several alterations have been made in the form of the still, particularly in Scotland, where it is an object of importance to be quick in the dispatch of the operation, on account of the mode of levying the duty; and, therefore, by gradually widening the bottom and contracting the height of the still, distillation is performed with a surprising rapidity. A still is said to have been constructed, which contains only 40 gallons in the body and three in the head, and in the use of it the whole time of its operation, from its commencement to its close, amounts only to $2\frac{3}{4}$ minutes, when the charge of wash is 16 gallons, or $\frac{2}{3}$ ths of the whole content. In rectification, which is a slower process, the charge is 24 gallons, and the time of distilling about 10 minutes.

A good spirit may be obtained without malting the grain, whether it be barley, or any other kind of corn which will answer the purpose. With us, a mixture of barley and malt is generally preferred; in Holland, the very best geneva is made from wheat and malt, though more commonly from malt and rye, the latter yielding more spirit than wheat.

The following process is that which is practised by most distillers. A quantity of rye-flour, coarsely ground, is mixed with a third or fourth part of malt, and put into the fermenting tub, with cold water, stirring it well with the hand, to prevent the meal from clotting. Water of a blood-warmth is then added, in sufficient quantity, after which the ferment, composed of the yeast of former operations, dried and kept for a certain time, is mixed with the whole. (See *FERMENT*.) When the weather is favourable, and the heat well regulated, the fermentation begins in six hours, and terminates on the third day, when the liquor becomes transparent, and assumes a hot pungent taste. The distillation is then immediately commenced, before the liquor turns sour, which should as much as possible be avoided. The distillation is conducted very slowly, to prevent the impregnation of the oil of the grain with the spirit, and of course the unpleasant flavour of the spirits. The first spirit is then rectified by a second distillation over juniper-berries, or in "double geneva," by a third process.

In some of the ordinary sorts, however, the juniper-berries are mixed with the fermenting materials, and one distillation suffices. In the common geneva or gin, vulgarly used in this country, the fine juniper flavour is coarsely imitated by turpentine. See *GENEVA*.

For the process of obtaining arrack, brandy, and rum, see *ARAC*, *BRANDY*, and *RUM*.

SPIRITS, Proof, or common saleable goods, are spirits of any kind of a determinate strength, being the same with those of good brandy, and the malt and sugar spirits of the distillery, as they are usually sold; containing equal quantities, or definite proportions, of rectified spirit and water.

The best proof spirit is that distilled from French wine; but for common use, the spirit drawn from molasses may be employed.

The common method of examining whether spirits have this due degree of strength is this:—take a long phial, fill it

half way with the common malt spirit, and give it a smart stroke by its bottom against the palm of the hand, there will then appear on the surface a chaplet, or crown of bubbles, which will go off again in a strong manner; that is, first remaining a while, and then going off by degrees, without breaking into smaller bubbles, or swelling into larger.

By this experiment all the traders in spirits judge of the strength of the goods they purchase; yet this is a mere fallacy and deception; for if only a little vinous or saccharine matter, as treacle, syrup, must, rob of fruits, or the like, be added to a quantity of highly rectified spirit of wine, this slight addition will give a brandy proof to that spirit. See *ALCOHOL*, *BRANDY*, and *BEAD Proof*.

Whether there be any secret for making weaker spirits shew this proof as well as brandies, &c. is not certainly known; but the thing is practicable, since arrack, which is but of half the strength of brandy, gives as fair a proof this way; and if a drop or two of any essential oil be added to a pint of brandy, it takes off its proof, and makes it appear much weaker than it is. The true strength may, however, always be known, by carefully burning away a measured quantity of brandy, &c. since if it leaves one half water it is right; if more or less, it is too strong, or too weak.

But beside the false method of judging of brandies by what is called *proof*, there is another not less fallacious one of judging of their goodness, though kept as a great secret in the hands of some dealers, and imagined a certain criterion to determine whether foreign brandies are mixed with corn spirits. These distillers are provided with a certain yellow liquor, a few drops of which being poured into a glass of right French brandy gives it a beautiful blue colour, and, by the strength and goodness of this colour, they judge and buy; but if common malt spirit be tinged with oak, it would give this colour equally with French brandy, and might be purchased as such. This proof tincture is expeditiously made, by dissolving a little green vitriol, first calcined to a redness, in a weak spirit of sea-salt, which thus becomes a yellow liquor, a single drop or two of which being added to a glass of any inflammable spirit, coloured yellow or brown with oak, or with long remaining in the cask, will instantly turn it of a bright and beautiful blue.

The best way of judging in these cases is by the nose and palate. Dilute a quantity of brandy considerably with water, and you will perceive the malt taste, if mixed with malt spirits; or burn a little in a spoon, and by the smell and taste of the water it leaves, you will easily judge whether there be malt in it.

Proof spirits may be distinguished into three kinds, *perfect proof*, *more than perfect proof*, and *less than perfect proof*. By *perfect proof* is usually understood that crown of bubbles, before mentioned, of a certain size, arising as a head upon a small quantity of a well-qualified spirit shook in a slender phial.

Proof more than perfect, is that in which the bubbles raised by shaking the spirits, are larger than those on the common or perfect proof, and go off more suddenly; that is, according as the spirit is higher, or approaches more to the nature of rectified spirit, or, as it is usually called, *spirit of wine*.

Proof less than perfect, is that in which the bubbles are smaller, and go off quicker and fainter than in perfect proof; the spirit in this case being mixed with more than its own quantity of phlegm, or being too poor for sale.

The surest method of judging of the strength of spirits, is by the hydrometer, water-poise, or balance; or, 2dly, by distillation, or finally, by deslagration. The specific gravity of totally inflammable spirit is so much less than that of phlegm,

phlegm, or common water, that it is easily sensible upon the balance; whence an exact hydrometer, well balanced and graduated, and furnished with a proper scale of weights, may be of great use to assign the proportions in which pure spirit and water are mixed in any given liquor. (See *Specific Gravity*, and *HYDROMETER*.) Though, perhaps, a readier way than this may be that of M. Homberg's, mentioned in the Memoirs of the Paris Academy, 1718, for determining the different gravities of different fluids, by means of a bottle with a very long and slender neck; which being filled to a certain height with any mixture of spirit, is weighed against the same bottle filled with pure water.

The most exact of all methods of determining the strength and spirit is by distillation, rectifying it up to an alcohol, or totally inflammable spirit; but this, though liable to no error, is too tedious to come into common use. And, upon the whole, the best method of all others, seems to be that of deslagration, which M. Geoffroy has been at much pains to adjust and improve.

In commerce, with regard to spirits, it would certainly be a much better method to abolish such uncertain proofs, and to make all the goods of the strength of what we call spirits of wine; that is, a totally inflammable spirit, whose purity is much greater, whose strength may always be found out with exactness, and whose bulk, stowage, carriage, and incumbrance, would be only half in regard to that of brandy, or proof spirits; and it might at all times, as occasion called for it, be mixed into a great variety of extemporaneous liquors, and the exact degree of strength would be always precisely known.

This operation, indeed, in the common way, proves so tedious and expensive, and, after all, so short of expectation, and so generally unsatisfactory, that it is not to be expected that the common distillers, till they have fallen into a better manner of working, should come into the proposal. But if, instead of the common way of rectifying by the hot-still, they would try the use of a large balneum Mariæ, made of a large rectangular boiler, and a set of tall conical vessels, they will find that little fire, and little attendance, and consequently very little expence, will, in this manner, furnish them with spirits reduced at once to this standard, and greatly superior, in all respects, to the common ones of the same strength. In this case there would be no need of any addition of salts; but the distiller may work more perfectly, and more expeditiously without them, and thus preserve the fine essential vinosity of the spirit, which, in the common way of working, they constantly lose.

The advantage of this method would be yet greater to the apothecaries, and the makers of compound cordial waters, who want only a pure spirit of such a strength, and suffer greatly in the fineness and perfection of their commodities, by the spirit they are obliged to use having in it a fulsome and nauseous oil of its own, which will always mix itself with their compositions, and the oils of the aromatics, &c. which they add to it. If spirits were brought to this standard for the market, there would be no possibility of deceit, and no farther examination need be made of it by the buyer than its burning perfectly dry in a spoon. Shaw's Essay on Distillery.

It is, however, to be observed, that though the burning of spirits away in a spoon may serve the trader in the common way, yet M. Geoffroy has observed, that they are no proofs for the philosopher, or the chemist, being not at all determinate or exact, though commonly supposed so.

From what has been said, it appears that brandy is much more inflammable than wine, and spirit of wine much more so than brandy, and ought to burn away without leaving

any remainder. Hence it is vulgarly supposed, that such spirit of wine as burns wholly away contains no phlegm, and that if two parcels of spirit both burn wholly away in this manner, they must be the same in strength, and in all other qualities; but M. Geoffroy has proved by experiment, that such spirit as burns wholly away, does yet contain a great deal of water, and two parcels both may burn thus away, and yet be very different; and that this trial is not determined by the entire absence of the phlegm, but by its proportion to the oil.

If the same spirit of wine, which in the common way of burning leaves no water, be again tried, by burning it in a hollow vessel set to float in a large quantity of cold water, it will then leave a considerable quantity of water; nay, all that is rectified only in the common way, leaves a large portion of phlegm on this experiment. The plain reason of which is, that this is the only fair trial, the other in the common way being fallacious. In this there is no more water left than was in the spirit; but in the other, the vessel becoming heated by the burning of the spirit, that heat gradually evaporates the water, as the spirit burns away; so that the one is as soon gone as the other. But keeping the vessel cool by external water, prevents that evaporation, and consequently retains and discovers all that cannot burn of the spirit.

The quantity of water thus discovered in spirit of wine is very great, and it has always been found, that in proportion as the experiment has been made more and more perfect, the spirit has always appeared proportionably less and less so.

Pure alcohol, or alcohol of a specific gravity of .796, at 60° Fahr., which is the strongest that can be procured, leaves no water; rectified spirit of moderate strength, 25 per cent.; French brandy, 56; and common malt liquor, 65.

The test for ascertaining the strength of spirits by pouring a few drops on gunpowder, is very incorrect. A more accurate test than any of these, and sufficient for common purposes, is to shake the spirit in a phial with very dry carbonate of potash, and observe the quantity of water attracted by the alkali, which indicates its strength. But the only certain mode of ascertaining the relative strength of spirits, is by determining the specific gravity of the spirit at a given temperature; thus, at 60° Fahr. the specific gravity of rectified spirit is .83599, at 65° it is .83362, and at 70° the gravity of the same spirit is .83134; while the gravity of the proof spirit of the London College, at the same degree of temperature, is .93002, .92794, and .92580, (see the table under SPIRITS, in the *Materia Medica*;) the weakest spirit having the greatest specific gravity, and this diminishing as the temperature increases. For ordinary purposes, the relative strength of spirits may be known by weighing the sample to be tried in a phial capable of holding exactly 500 grains of water. An equal bulk of rectified spirit weighs 418 grains, and of proof spirit 465; hence the number of grains above or below these sums will indicate the relative strength of the spirit.

The quality of the phlegm that is left is also of use to judge of the spirit by; if that were perfectly fine, this ought to be perfectly limpid and clear, and without taste or smell: as it wants either of these properties, it is a proof of the want of perfection of the spirit it is obtained from; but the greatest of all defects, is its having a coarse oil swimming upon it, and giving the colours of the rainbow in different lights. Mem. Acad. Par. 1718. See BRANDY.

SPIRITS, *Colouring of*, the art of giving to distilled liquors a colour, which takes off their watery appearance, and gives them a resemblance of the foreign brandies, &c.

The colouring is not only necessary on this account, but as we usually esteem the spirits by the proof of the crown of bubbles, it is found that the clean rectified spirit will not afford this proof till it has received its dose of the colour. The distillers dispense this colour in any proportion that they find convenient or necessary; it is always yellow, but, according to the degree, differs extremely in deepness, from the palest straw-colour to the deepest orange. This art of colouring was first introduced, from observing that all the fine and soft foreign brandies, that had the mellowness necessary to their perfection to the taste, had also a yellow colour. The colour, in this case, has indeed nothing to do with the flavour; but that being kept in casks the same age that was necessary to give them this mellowness, would also give them a colour from the wood. It was hence supposed, that the particular excellence of the foreign brandies depended on the woody colour, and accordingly pains have been taken to give the same colour to our spirits by various methods.

The way of obtaining it, by many years standing in the cask, proved too tedious for our hasty workmen, and accordingly they provided means of giving it extempore by strong tinctures of several ingredients; the chief of which are logwood, saffron, Japan earth, treacle, burnt sugar, and oak-chips; the three former of these have but little to recommend them, but the others are found very ready, and very proper for the use.

Treacle gives a fine colour not much unlike that of the foreign brandies, and being necessarily used in a large quantity, as its colour is but dilute, it not only mends the bubble, or bead-proof, impaired by the rectification, but also gives it a fulness in the mouth; both which properties are very agreeable to the vulgar, who are the chief retail consumers of these coarse goods.

Burnt sugar, that is, sugar dissolved in a little water, and scorched over the fire till it turns black, goes much farther in the colouring than treacle, and at the same time gives no sweetness, but rather an agreeable bitterness; and thus recommends itself to the nicer palates, that are not for a luscious spirit. Indeed sugar, thus treated, tinges to a great perfection, and that without loss of time, and with as much cheapness as can well be desired.

The last article mentioned, namely oak-chips, is of all others the most natural for imitating the dye of foreign spirits, as it is the very wood of which the casks they come over in are made, and from which they take that colour of which we are so fond. The colouring with oak has also this farther advantage in spirits meant as sophistications of the foreign ones, that it will stand some tests usually had recourse to on the occasion, which the others will not stand.

Common spirit poured on oak-chips, and digested in a moderate heat, easily fetches out the resinous part of the wood on which the colouring depends; but then it does not go near so far as the burnt sugar; a large quantity of oak being required to colour a small parcel of brandy, or spirits. It is adviseable not to make the tincture every time, but to have recourse to an extract of this wood in a liquid form: this extract is best made in two menstrua, alcohol and water, and may be evaporated to any strength, so that a very small dose of it will tinge a great quantity of liquor. The two liquid extracts will be mixed together, and as they will be apt to separate in standing, it will be proper to add to them, when newly made, a quantity of fine sugar; this will give a body to the whole, and it will keep better from mouldiness than it would without it. Shaw's Essay on Distillery.

SPIRITS, Convertibility of. This is a doctrine that has obtained among many of the most curious experimenters, and, indeed, the most intelligent of our chemists have always allowed, that provided proper care were taken in the getting together of the material, one spirit may always be changed into another, as brandy into rum, malt-spirit into brandy and brandy into malt-spirit. The principles on which this is believed are these.

All simple spirits (as they are called) consist of four parts, water, oil, phlegm, and alcohol; the last of these is the essential part, and is what constitutes the whole a spirit. In reducing spirits, therefore, to their utmost degree of simplicity and purity, it is evident that the three superfluous parts are to be got rid of, and the fourth left alone; by this means the alcohol is procured distinct, and is a liquor *sui generis* of many peculiar qualities, not to be found in any other fluid.

Among others, it has these remarkable properties: 1. When absolutely purified, it is an uniform and homogeneous liquor, capable of no farther separation, without loss or destruction of some of its homogeneous parts. 2. It is totally inflammable, leaving no foot nor any moisture behind. 3. It has no peculiar taste or flavour, any more than pure water, except what is owing to its nature as alcohol, or perfectly pure spirit. 4. It is an unctuous and crispy fluid, running veiny in the distillation, and its drops rolling on the surface of any other fluid, like pease upon a table, before they unite. 5. It appears to be the essential oil of the body it is obtained from, broken very fine, and intimately and strongly mixed with an aqueous fluid, which is assimilated, or changed in its nature in the operation. 6. And lastly, it seems to be a kind of universal fluid, producible with the same properties from every vegetable subject; but to produce it thus requires some care in the operation. See ALCOHOL.

On these principles is founded the opinion, that all spirits may be reduced to a perfect similarity, or sameness, from whatever subject they were procured, and on this depends their convertibility into one another; for when once they are brought to this standard of simplicity, there needs nothing more than to add the oil of such of the finer spirits as is required to convert the spirit into that particular kind. By this means the same tasteless spirit, whether obtained from malt, sugar, or grapes, may be made either into malt-spirit, brandy, or rum, by adding the essential oil of the grape, sugar, or malt; and thus, what was once malt-spirit, shall become brandy, or whatever else the operator pleases.

Many methods have been attempted to obtain the first point, that is, the reducing of the spirit to perfect and pure alcohol. The most practicable means seem to be long digestion, and the repeated distillation from water into water, where the essential oil will at once be left upon two surfaces, and the acid imbibed. The shorter ways are those by rectifying from neutral absorbent salts and earths; such as sugar, chalk, and the like. And lastly, the use of fixed alkalies may be tried, for these very forcibly keep down both the phlegm and oil; inasmuch that this last method promises to be the shortest of all, if the art were known of utterly abolishing the alkaline flavour, which the alcohol is apt to acquire in this operation, and which, for this purpose, is by no means suitable, as absolutely destroying all vinosity, which universally consists in a fine volatile pungent acidity. The distillers are the only people whose business would lead them to make the experiment. This method of converting one spirit into another, would be of immense

profit to them if they could perfectly succeed in it; but as it would require time and slow processes to bring it about, there is but little hope of its ever being brought to bear among them, while they are in their present scheme of doing every thing with dispatch and hurry.

Dr. Shaw has said a vast deal in the praise of a tasteless spirit, which is producible from a vegetable substance, only overlooked, as he tells us, because it is too common, with which all the foreign spirits might be imitated to the utmost perfection by means of their essential oils, all thin fine wines raised to any due degree of strength, without giving them the brandy flavour, and many other things of great use performed; but he has not told us what the vegetable substance is from which we are to obtain this. Shaw's Essay on Distillery.

SPIRIT, *Ardent*, called also *spirit of wine*, because it can only be obtained from substances which have undergone the vinous fermentation, is a very light, very volatile, very fluid liquor, perfectly white and limpid, and of a strong, penetrating, agreeable taste and smell. See **ALCOHOL**.

Spirits drawn from wine, such as French brandy, may, in a great measure, be purified or rectified by simple distillation, in tall vessels with a gentle heat, the pure spirituous parts rising before the phlegm: if French brandy be thus distilled to one-half, the distilled spirit proves tolerably pure. See **BRANDY**.

But wine or brandy being in this country too dear an article for distillation, this purification is chiefly practised on the cheaper spirits of molasses and malt-liquors. To separate the offensive oil with which these abound, after they have been freed by distillation from the greatest part of their phlegm, they are mixed with an equal quantity of spring-water, and the spirit drawn off again by a gentle heat: a considerable portion of the oil is thus left behind in the water, which now proves turbid and milky, and very nauseous both in smell and taste. The first produce is the strongest and purest, and when it has come over to the amount of $\frac{1}{4}$ th of the whole contents of the still, forms the rectified spirit. By repeating this ablution with fresh quantities of water, the foulest and most offensive spirits may be purified from all ill flavour. To complete the purification, or free them from their remaining phlegm or oil, or the watery vapour which is raised even by the gentlest heat in which they can be distilled, a little fixed alkaline salt, thoroughly dried and powdered, or lime, or some other article of a like kind, is added; which, imbibing the phlegm, is thereby dissolved into a ponderous liquid, that does not mingle with the spirit, but settles at the bottom. If the spirit is very phlegmatic, four pints will require a pound of the alkali; if the distillation has been performed with due care, half this quantity, or less, will be sufficient: in either case, if all the salt dissolves, the spirit is to be digested with a little more, till at least a part remains undissolved. The spirit now poured off is to be again distilled, in order to separate from it a portion of the salt which has united with it, and which, though extremely minute, may in some respects change its qualities. As some particles of the alkali are apt to be carried up with it, even in the distillation, so as to communicate an ill flavour, or an urinous taste, it is advisable previously to add a small portion of calcined vitriol, or burnt alum and charcoal, which will completely absorb the alkali, without giving any new impregnation to the spirit. Malt-spirits, when properly rectified, yield as pure and as strong rectified spirit as brandy. Lewis's Mat. Med. See **DISTILLATION**, and **SPIRITS**, in the *Materia Medica*, infra.

When only a small quantity of spirit of wine is to be rectified, the usual operation for this purpose, by means of distillations of the spirit called *aqua vitæ*, obtained from the first distillations of liquors that have undergone the spirituous fermentation, and which are overcharged with a large quantity of phlegm and light oil, is difficult. These distillations being slowly conducted with a gentle fire and water-bath, yield but a small quantity of that liquor, which, being the most volatile, rises first with the least heat, and which is the true or rectified spirit of wine. Several chemists, therefore, in order to obtain a larger quantity of the first spirit, propose to mix with the spirit of wine some intermediate substances, to absorb and retain its phlegm and oil, such as dried and calcined salts, very dry chalk, &c. Kunckel proposes to separate more effectually the oil, by adding to the spirit a large quantity of water, and by distilling this diluted spirit with a very gentle heat. But the trouble and inconvenience of depriving the spirit of wine of the water with which it was diluted in this process, may be avoided, by rectifying at once a large quantity of *aqua vitæ*. Nothing more is required to obtain at once a considerable quantity of pure spirit of wine, than to set aside the twelve or fifteen pints first drawn over from a large quantity, *e. g.* from three hundred pints of *aqua vitæ*, distilled with a very gentle fire in a large alembic. As the most spirituous, least aqueous, and least oily part of it always rises first, these twelve or fifteen pints are perfectly rectified spirit of wine, especially when the heat has been well conducted.

By thus keeping apart portions of the spirit obtained, at different times, we may have spirit of wine of the several degrees of strength and purity. The weaker spirit may, by another distillation, be again rectified; and the spirit of moderate strength may be preserved for many uses. The method is followed by M. Beaumé in the rectification of spirit of wine, and is certainly the most convenient and the best.

A perfectly rectified spirit of wine, or such as is entirely freed from water, is undoubtedly a thing of frequent and necessary use in the nice operations of chemistry.

It had used to be prepared, either by often distilling the spirit, and every time drawing over only half of it, and repeating this till the half remaining in the cucurbit appeared as strong as that drawn over; or else by raising it to a great height from the body of the vessel, and this in a very gentle heat, so that spirit alone could rise, the water not being capable of being driven so far by that degree of heat.

But the accurate Boerhaave always found upon trial, that there was still remaining some water in these spirits, whether prepared by the first or second process, or both. Boerhaave's Chem. part ii. p. 124.

The method he therefore invented is this: fill a still half full of the spirit prepared for alcohol in one or other of these ways, and add to it half a pound of pure decrepitated, and perfectly dried sea-salt; put this in hot, then place on the head, and carefully lute the junctures; leave this for twelve hours in a heat so small, as not to make the alcohol boil, then distil off the spirit; keep the first two ounces apart, because some aqueous vapour may have happened to lodge in the head or worm of the still, which this certainly washes off; after this receive two-thirds of the following alcohol into a pure dry glass vessel, and keep it perfectly stopped; then draw off the remainder, and keep that by itself: there will remain a moist salt in the still, which has attracted the aqueous matter of the alcohol, and held it so down, that it could not rise by the heat of boiling water, which

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which is all that must be used in this distillation; and the salt having been first decrepitated, never makes any change in the alcohol by adding any thing to it. By this means an alcohol is prepared perfectly pure, and fit for all the uses of chemistry.

For the tests and properties of pure alcohol, see **ALCOHOL**.

M. Reaumur discovered, that a mixture of spirit of wine and water acquired a specific gravity greater than that which would arithmetically result from the proportions employed of each of these liquors. Thus, fifty measures of spirit of wine, and fifty measures of water, mixed together, were found to make only ninety-eight measures; but in what progression the density is increased by mixing various proportions of the two liquors, had not been determined till M. Brisson made a set of experiments with that view; an account of which is given in the Memoirs of the Academy of Sciences of Paris, for the year 1769.

From his experiments he has constructed the following table, which shews this progression, and also enables us to discover the proportion of spirit of wine and water, in any given mixture of these (as brandies, rums, &c.), the specific gravity of which is found to correspond with any of the specific gravities in the table. Thus, for instance, if we find upon accurate trial, that the specific gravity of the rum, brandy, or other mixture, whose strength is required to be known, be to that of water as $942\frac{1}{2}$ to 1000, we learn, by inspection of the table, that this spirituous mixture consists of equal parts of water and spirit of wine, of which spirit the strength is such, that its density is to that of the water as 837 to 1000. The first column shews the proportion of well rectified spirit of wine in the mixture; the second column shews the proportion of the water in the mixture; the third column shews the specific gravity of the mixture; the fourth column shews the difference between the specific gravity of the mixture and that of the preceding mixture; and the fifth column shews the proportion which the several augmentations of density, caused by penetration of the two liquors, have to each other, that is their progression.

Spirit of Wine.	Water.	Specific Gravity.	Differences.	Proportionable Augmentations of Density from Penetration.
Parts.	Parts.			
16	0	837	0	0
15	1	852 $\frac{1}{2}$	15 $\frac{1}{2}$	4 $\frac{5}{8}$
14	2	867 $\frac{1}{2}$	14 $\frac{5}{8}$	8 $\frac{3}{8}$
13	3	881 $\frac{1}{2}$	14	11 $\frac{1}{8}$
12	4	894 $\frac{1}{2}$	13 $\frac{1}{2}$	13 $\frac{1}{8}$
11	5	907 $\frac{1}{2}$	12 $\frac{5}{8}$	15 $\frac{1}{8}$
10	6	919 $\frac{3}{4}$	12 $\frac{1}{4}$	17 $\frac{3}{8}$
9	7	931 $\frac{3}{4}$	12	19 $\frac{1}{8}$
8	8	942 $\frac{1}{2}$	10 $\frac{5}{8}$	19 $\frac{1}{8}$
7	9	951 $\frac{1}{2}$	9 $\frac{1}{8}$	18 $\frac{3}{8}$
6	10	959 $\frac{1}{2}$	8	17 $\frac{1}{8}$
5	11	967 $\frac{1}{2}$	7 $\frac{7}{8}$	15 $\frac{1}{8}$
4	12	973 $\frac{1}{2}$	5 $\frac{1}{2}$	11 $\frac{6}{8}$
3	13	979	5 $\frac{5}{8}$	7 $\frac{1}{2}$
2	14	985	6	4 $\frac{7}{8}$
1	15	991 $\frac{1}{2}$	6 $\frac{1}{4}$	1 $\frac{1}{8}$
0	16	1000	8 $\frac{1}{2}$	0

Spirit of wine is used in dyeing, as a non-colouring drug, and though it gives no colour itself, it serves to prepare the stuffs to receive other colours. Its consumption is also very

considerable in several other works and manufactures, particularly the making of varnish.

Proof-spirit cannot be used for burning in lamps, for dissolving resins, and for making varnish; and there is also a great number of tinctures, solutions, and mixtures, for which it cannot serve; but rectified spirit, or alcohol, besides its ready use for medicinal purposes, may, when the spirit is of a proper kind, be made into punch, and all other mixtures, with greater purity, and much greater certainty and exactness in point of strength. See next article and **ALCOHOL**.

SPIRITS, in the *Materia Medica*, "rectified spirit" of the London Pharmacopœia; "alcohol," "spiritus vinosus rectificatus five purissimus," Edinb.; "spiritus vinosus rectificatus," Dub.; is alcohol nearly in the highest state of concentration in which it can be easily prepared in the large way for the purposes of trade. The London and Edinburgh colleges state its specific gravity to be to that of water as 835 to 1000, while the Dublin college states it at 840. The Edinburgh college names this spirit alcohol; but directions being given both by the London and Dublin colleges, for the preparation of a still stronger spirit, the name of alcohol, in their pharmacopœias, is judiciously retained for the stronger spirit, while that of rectified spirit is applied to the present preparation.

The alcohol of the Lond. Ph. is prepared by taking of rectified spirit a gallon, and of subcarbonate of potash, three pounds: add a pound of the subcarbonate, previously heated to 300 degrees, to the spirit, and macerate for 24 hours, frequently shaking the mixture; then pour off the spirit, and add the remainder of the subcarbonate, heated to the same degree; and lastly, distil the alcohol from a water-bath, and preserve it in a well-closed vessel. The specific gravity of this alcohol is to that of distilled water as 315 to 1,000.

The alcohol of the Dub. Ph. is prepared by taking of rectified spirit of wine, a gallon; pearl-ashes, dried at a heat of 300°, and still hot, a pound; caustic kali, in powder, an ounce; muriate of lime, dried, half a pound. Mix the spirit and the kali; add the pearl-ashes, previously reduced to powder, and digest the mixture for three days in a closed vessel, frequently shaking it; then pour off the spirit; mix with it the muriate of lime; and lastly, distil with a moderate heat, until the residue begins to thicken. The specific gravity of this spirit is to that of distilled water as 315 to 1000.

Rectified spirit of the specific gravity of 835, contains about 15 per cent. of water; and to free it from this is the intention of the above processes. The Edinburgh college has no process for the preparation of pure alcohol, which may be easily dispensed with; but it has very improperly given this title to the rectified spirit of the other pharmacopœias. The theory of the operation is sufficiently obvious. The affinity of the alkali and the muriate of lime for water is much greater than that of the spirit: it is, therefore, attracted by these substances, and prevented from rising with the spirit during the distillation, by which means the alcohol comes over in a very highly concentrated state. Of the two processes, that of the Dublin college is to be preferred; muriate of lime being a much more powerful agent for separating the water, which is the object in both, than subcarbonate of potash.

Dr. Black thus obtained alcohol of the sp. gr. of 800°, and Richter procured it so low as 0.792, in the temperature of 68° Fahr. at which degree of concentration it may be regarded almost as pure alcohol, or alcohol perfectly free from water, though more than sufficiently concentrated for all the purposes of pharmacy.

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The following Table, drawn up by Lowitz, with an additional column by Dr. Thomson, shews the specific gravity of different mixtures of pure alcohol, of a specific gravity .791, and distilled water, at the temperatures of 60° and 68° of Fahrenheit.

100 Parts by Weight.		Sp. Gravity.		100 Parts by Weight.		Sp. Gravity.	
Alcohol.	Water.	At 68°.	At 60°.	Alcohol.	Water.	At 68°.	At 60°.
100	—	791	796	49	51	917	920
99	1	794	798	48	52	919	922
98	2	797	801	47	53	921	924
97	3	800	804	46	54	923	926
96	4	803	807	45	55	925	928
95	5	805	809	44	56	927	930
94	6	808	812	43	57	930	933
93	7	811	*815	42	58	932	935
92	8	813	817	41	59	934	937
91	9	816	820	40	60	936	939
90	10	818	822	39	61	938	941
89	11	821	825	38	62	940	943
88	12	823	827	37	63	942	945
87	13	826	830	36	64	944	947
86	14	828	832	35	65	946	949
85	15	831	†835	34	66	948	951
84	16	834	838	33	67	950	953
83	17	836	‡840	32	68	952	955
82	18	839	843	31	69	954	957
81	19	842	846	30	70	956	958
80	20	844	848	29	71	957	960
79	21	847	851	28	72	959	962
78	22	849	853	27	73	961	963
77	23	851	855	26	74	963	965
76	24	853	857	25	75	965	967
75	25	856	860	24	76	966	968
74	26	859	863	23	77	968	970
73	27	861	865	22	78	970	972
72	28	863	867	21	79	971	973
71	29	866	870	20	80	973	974
70	30	868	871	19	81	974	975
69	31	870	874	18	82	976	
68	32	872	875	17	83	977	
67	33	875	879	16	84	978	
66	34	877	880	15	85	980	
65	35	880	883	14	86	981	
64	36	882	886	13	87	983	
63	37	885	889	12	88	985	
62	38	887	891	11	89	986	
61	39	889	893	10	90	987	
60	40	892	896	9	91	988	
59	41	894	898	8	92	989	
58	42	896	900	7	93	991	
57	43	899	903	6	94	992	
56	44	901	904	5	95	994	
55	45	903	906	4	96	995	
54	46	905	908	3	97	997	
53	47	907	910	2	98	998	
52	48	909	912	1	99	999	
51	49	912	915	—	100	1000	
50	50	914	917				

* Alcohol of the London and the Dublin Pharmacopœias. † Ditto (Edinburgh); rectified spirit (London). ‡ Rectified spirit (Dublin). § Proof spirit (Lond. Dub.) || Ditto (Edinburgh).

In the extract from Mr. Gilpin's table (see *Specific Gravity*), the standard spirit was of the specific gravity of 0.825, or contained 89 pure alcohol, and 11 water, in 100 parts.

Pure rectified spirit has a fragrant odour, and a hot highly pungent taste. It is colourless; always fluid; cannot be congealed at any known degree of cold; evaporates speedily at the ordinary temperature of the atmosphere; boils at 163° Fahrenheit; and is extremely inflammable, burning with a blue lambent flame, without any sensible smoke. Like alcohol, it combines with water in every proportion; and, on account of its affinity for water, precipitates many of the neutral salts from their aqueous solutions. It is capable of dissolving many saline bodies, and is the proper solvent of the greater number of the proximate principles of vegetables. Its constituents are 85 of pure alcohol and 15 of water, in 100 parts, when its specific gravity is 835, at a temperature of 60° of Fahrenheit; but 83 only of pure alcohol, and 17 of water, when it is 840, as designated by the Dublin college.

Rectified spirit is a very powerful stimulant. In its undiluted state it is never exhibited as a remedy; and is merely employed for forming the diluted spirit, and as a pharmaceutical agent.

The "spiritus tenuior," or "weaker spirit," of the Lond. Ph.; the "diluted alcohol," the "spiritus vinosus tenuior five dilutus" of Edinb. Ph.; and "spiritus vinosus tenuior" of Dub. Ph., or "proof spirit," is merely rectified spirit diluted with a certain proportion of water. According to the London and Dublin colleges, its specific gravity should be to that of distilled water, as 930 to 1000; while the Edinburgh college orders it of the gravity of 935. The former may be formed by mixing four parts by measure of rectified spirit with three of water, and contains 44 parts of pure alcohol, and 55 of water, in 100 parts; the latter is obtained from equal parts of rectified spirit and water, and contains 42 of pure alcohol, and 58 of water, in 100 parts. Alcohol, diluted to the degree of proof-spirit, is still a very powerful diffusible stimulant, and too strong for internal use. Externally applied, it is recommended in burns; to restrain bleeding in passive hæmorrhagies; and as a friction or fomentation to relieve muscular pains; and in a more diluted state it forms a good collyrium in the latter stage of ophthalmia. Proof-spirit diluted with water is employed as a remedy in the form of tinctures and spirits; and the ardent spirits in common use may be regarded as nearly of the same nature. These taken in moderation, increase the general excitement, communicate additional energy to the muscular fibres, strengthen the stomach, and exhilarate the mind. Hence they are often and advantageously used in cases of debility and low typhoid fevers, in which the use of wine is indicated; and in habits disposed to create acidity, they are even preferable to wine; some of them, particularly brandy, proving gratefully stomachic, when wine is nauseated and rejected. As an article, however, of daily or dietetical use, particularly if taken in immoderate doses, or long continued, ardent spirits, besides being the source of much moral evil, and debasing the human character nearly to a level with that of brutes, are apt to occasion disease, and are commonly the origin of dyspepsia, hypochondriasis, and hepatic and visceral obstructions. The hurtful effects of ardent spirits, however, are obviated in a considerable degree by diluting them with water, and adding lemon-juice and sugar to the mixture, so as to form what is generally known by the name of punch. Although all the varieties of ardent spirits may be regarded as diluted alcohol, yet each has a peculiar operation: thus, brandy

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brandy is simply cordial and stomachic; rum, heating and fudorific; gin and whisky, diuretic; and arrack, styptic, heating and narcotic, and ill adapted to European constitutions.

Vinous spirits, therefore, in small quantity, and properly diluted, may be applied to useful purposes in the relieving of some disorders; whilst in larger ones, or imprudently continued, they act as a poison of a particular kind. The moderate use of them is most serviceable to those who are exposed to heat and moisture, to corrupted air, or to other causes of colliquative and putrid diseases; and they are the most pernicious in opposite circumstances, and to those who are afflicted with hysterical and hypochondriacal complaints: for whatever temporary relief these spirituous cordials may afford in the lownesses to which hysterical and hypochondriacal persons are subject, there are none, as Dr. Pemberton observes, who feel so soon the ill effects arising from the habitual use of them. Lewis's Mat. Med.

The power of brandy, or any thing of this kind, in killing worms, is evident from this, that the children of the people in the northern islands of Scotland, who are accustomed from their infancy to drink that coarse sort of brandy which they call aqua vitæ, never are troubled with worms. It is a dangerous practice to use brandy in this general manner, but on some occasions it may be very serviceable. Philof. Tranf. N^o 233.

SPIRITS, Laws relating to Foreign and British. By a variety of statutes, which it would be too tedious here to enumerate, duties both permanent and temporary, of the customs and the excise, have been imposed on brandy, rum, arquebuse, geneva, arrack, and spirits, the amount of which is very considerable in proportion to the original price. By 43 Geo. III. c. 69. (sched. A), and 43 Geo. III. c. 81. several duties are imposed upon spirits imported; but by 49 Geo. III. c. 98. several duties of customs are imposed: the said duties are payable by the importer, before landing. If any person shall land any French brandy, before the duty be paid or secured, or without licence from the proper officer, and conceal the same when landed, he and his aider shall not only forfeit the same, but also double value; and if any officer of the customs or excise shall connive at it, he shall forfeit 500*l.*, and be incapable of holding any office in the revenue. (1 Ann. stat. 2. c. 14.) The officers of excise may go on board any ship and search, as officers of the customs may do, for any exciseable liquors, and seize such as shall be forfeited, and such as shall be unshipped before entry and payment of the duties, together with the casks and other package. (11 Geo. I. c. 30.) Any officer of the excise may search for concealed foreign spirits, and seize, &c.; and the penalty of obstruction is a forfeiture of 100*l.* By a general clause in 8 Geo. I. c. 18. all brandy, arrack, rum, spirits, and strong waters, and all foreign exciseable liquors, forfeited, together with the casks and package, may be seized by any officer of the customs or excise, or persons deputed from the lord treasurer, or undertreasurer, or by special commission under the great or privy seal, and no other person; and the penalty of obstruction is 40*l.* If any foreign brandy, arrack, rum, or strong waters, or spirits of any kind, shall be imported in any vessel of 100 tons burden, or under, (except for the use of seamen, not exceeding two gallons each,) such vessel, with its tackle, and also the spirits, shall be forfeited (5 Geo. III. c. 43.): except rum or other spirits of the growth and manufacture of the British sugar plantations, which may be imported in any vessel of not less burden than 70 tons. (6 Geo. III. c. 46.) If any vessel of 50 tons, or under, partly or fully laden with brandy, be at anchor or within two leagues of the

shore, and not proceeding on her voyage, if wind and weather permit, such vessel may be compelled by the commander of any man of war, or armed sloop appointed to guard the coast, or the commander of any vessel in the service of the customs, to come into port; and the case is the same with ships hovering near the coasts. (6 Geo. I. c. 21.) If any vessel come from foreign parts, and have on board any foreign brandy or spirits, in casks under six gallons, (except for the use of seamen, not exceeding two gallons each,) shall be found at anchor, &c. as in the former case, all such spirits, with the casks and package, or value, shall be forfeited, and the same may be seized, or value sued for by the officers; and if the vessel do not exceed 50 tons in burden, the said vessel, with her tackle and furniture, shall be forfeited: and if any person, having charge of the vessel, shall suffer any brandy to be put into lighters or boats, in order to be landed, he shall, besides other penalties, suffer six months' imprisonment. No brandy shall be imported in any vessel not containing 60 gallons at the least, on pain of forfeiting the same, or value. (4 W. c. 5.) And no geneva or rum shall be imported in any vessel or cask, not containing 60 gallons at least, (except for the use of seamen, not exceeding two gallons each,) on pain of forfeiture. (5 Geo. III. c. 43.) If any officer shall find any increase of rum or spirits, (except such as have been imported and lodged in a warehouse, according to law,) above the quantity found on the last survey, or any decrease, (beyond the quantity legally delivered or allowed for leakage,) the proprietor or importer shall forfeit 500*l.*; and opening the warehouse, except in the presence of the warehouse-keeper or excise officer, incurs a forfeiture of 500*l.* If any rum or spirits remain in the warehouse above twelve calendar months (6 Geo. III. c. 47.), without paying the duty, the commissioners of excise may sell them by auction, and pay the duty and charges, transferring the overplus to the proprietor or importer. A permit shall be obtained for removal of the quantity sold; nor shall any liquor, exceeding one gallon, be carried away without such permit, on pain of forfeiting the same, with the casks and vessels. If the liquor be not removed, and the permit not returned, the person that took it out shall forfeit treble value. No person shall receive a permit, without direction in writing of the person (or his servant) from whose stock the goods are to be removed, on pain of 50*l.*; and in default of payment, three months' imprisonment. No foreign spirits, although under one gallon, shall be received into the custody of any retailer, without a permit, signifying that the duties were paid, or that they had been condemned, on pain of forfeiting the same. (8 Geo. I. c. 18.) No feller or dealer shall be allowed to take out more than one permit in one day; provided that several permits may be taken out, and casks containing foreign spirituous liquors sent to the same persons the same day, so that each cask may be sent under different permits, and by different conveyances; and provided dealers shall not be prevented from sending with one permit by one and the same conveyance any number of casks, containing 60 gallons each, or upwards, of the same kind. Foreign spirits, not being casks of 60 gallons, or upwards, shall not be removed, unless at the following times; that is, from September 29th to March 25th, yearly, between the hours of seven in the morning and five in the evening; and from March 25th to September 29th, between the hours of five and seven, (except the same is carrying by a known common stage-coach, waggon, or other stage carriage, usually travelling out of these hours,) on pain of forfeiture, with or without a permit. (23 Geo. III. c. 70.) No foreign spirits more than 60 gallons shall be brought to London by

one permit, or one conveyance, at the same time, from any part of England by land or water, (except by Gravesend, in the ordinary course of commerce,) on pain of being seized and forfeited. (26 Geo. III. c. 73.) If any person shall counterfeit a permit, or give or receive any false permit, or alter any granted by the proper officer, he shall forfeit 500*l.* 23 Geo. III. c. 70.

For the conditions, regulations, and restrictions, under which rum imported from the West Indies may be secured in warehouses, without payment of duty, see 43 Geo. III. c. 132. 45 Geo. III. c. 87. 46 Geo. III. c. 137. and 48 Geo. III. c. 126; and for those under which brandy, geneva, and other spirits, may be secured in warehouses, without payment of duty, see 43 Geo. III. c. 132. 45 Geo. III. c. 87. 46 Geo. III. c. 137. and 48 Geo. III. c. 126. For other laws and regulations, see CUSTOMS, DISTILLER, EXCISE, SMUGGLING, and WINE.

SPIRIT of Ammonia, in the *Materia Medica*, is prepared, according to the directions of the Lond. Ph., by mixing two pints of rectified spirit with a pint of solution of ammonia. The "ammoniated alcohol," formerly *spirit of ammonia*, of the Ed. Ph., consists of 32 oz. of alcohol (835), 12 oz. of lime recently burnt, and 8 oz. of muriate of ammonia; and is prepared in the same manner as water of ammonia. (See AMMONIA.) The *spirit of ammonia* of the Dub. Ph. is prepared by mixing three pints of proof-spirit, 4 oz. of muriate of ammonia, and 6 oz. of potashes; and distilling, with a moderate heat, two pints. This spirit, properly prepared, has the pungent odour and acrid taste of ammonia, with which it coincides in its medicinal properties. (See AMMONIACAL Preparations.) It is chiefly used for pharmaceutical purposes. The official preparations are "spiritus ammoniæ compositus," "spiritus ammoniæ fetidus," "tinctura castorei composita," "tinctura guaiaci composita," and "tinctura opii composita."

SPIRIT of Ammonia, Aromatic, is prepared, according to the Lond. Ph., by mixing two pints of spirit of ammonia with oil of lemon and oil of cloves, of each two fluid-drachms. The "aromatic ammoniated alcohol," formerly *aromatic spirit of ammonia*, of the Edinb. Ph., is composed of 8 oz. of ammoniated alcohol, 1½ drachm of volatile oil of rosemary, and a drachm of volatile oil of lemons, which are mixed so as to dissolve the oils. The *aromatic spirit of ammonia* of the Dub. Ph. is formed by digesting two pints of spirit of ammonia, two drachms of essential oil of lemons, and half an ounce of bruised nutmegs, in a covered vessel for three days, frequently shaking the vessel; and then distilling a pound and a half. This spirit is an useful stimulant in languors, and flatulent colic; and the oils render it more grateful to the stomach than the simple spirit of ammonia. The dose is from fʒss to fʒj, in any convenient vehicle. The officinal preparations are "tinctura guaiaci ammoniata," and "tinctura valerianæ ammoniata."

SPIRIT of Ammonia, Fetid, is prepared, according to the Lond. and Dub. Ph., by macerating two pints of spirit of ammonia, and 2 oz. of assafœtida (1½ oz. Dub.), for 12 hours (for three days, in a covered vessel, with frequent agitation, Dub.); and then by a gentle fire distilling a pint and a half into a cold receiver. The "fetid ammoniated alcohol," formerly *fetid spirit of ammonia*, of the Edinb. Ph., is prepared by digesting 8 oz. of ammoniated alcohol, and ½ oz. of assafœtida, in a close vessel for 12 hours, and then distilling 8 oz. by the heat of boiling water. The medicinal properties of this spirit, and the dose, are the same with those of the preceding. It acquires colour from age.

SPIRIT of Ammonia, Succinated, of the Lond. Ph., is prepared by macerating three drachms of mastic in nine fluid-drachms of alcohol, so that it may be dissolved, and pouring off the clear tincture; then adding fourteen minims of oil of lavender, four minims of oil of amber, and ten fluid-ounces of solution of ammonia, and mixing them by agitation. This spirit is employed as a stimulant and antispasmodic, in the same cases as the oil of amber, and has been used with success in India against the bite of the rattlesnake. The dose is from ℥ʒx to fʒss, in any convenient vehicle. See AMBER.

SPIRIT of Anise-seed of the Lond. Ph. is formed by macerating for 24 hours half a pound of anise-seeds bruised, a gallon of proof-spirit, and a sufficient quantity of water to prevent empyreuma, and distilling by a gentle fire. The *compound spirit of anise-seed* of the Dub. Ph. is obtained by distilling one gallon from anise-seeds and angelica seeds bruised, of each half a pound, a gallon of proof-spirit, and water sufficient to prevent empyreuma. In flatulent colic, and similar affections, these are pleasant carminatives. The dose is from fʒss to fʒiv, in water.

SPIRIT of Horse-radish, Compound, "spiritus armoraciæ compositus," of the Lond. Ph., is prepared by macerating fresh horse-radish sliced and orange-peel dried, of each a pound, half an ounce of nutmegs bruised, a gallon of proof-spirit, and water sufficient to prevent empyreuma, for 24 hours, and distilling a gallon by a gentle fire. (See COCHLEARIA.) The "compositus spiritus raphani," of the Dub. Ph., is formed by distilling two gallons from horse-radish dried and peel of Seville oranges, of each two pounds, four pounds of fresh garden scurvy-grass, one ounce of nutmegs bruised, two gallons of proof-spirit, and water sufficient to prevent empyreuma. These spirits, which were formerly used as antiscorbutics, are now held in little estimation in that intention. They are chiefly used in dropfies, attended with much debility. The dose is from fʒj to fʒiv, combined with infusion of fox-glove or juniper-berries.

SPIRIT of Camphor of the Lond. Ph. is prepared by mixing four ounces of camphor with two pints of rectified spirit, that the camphor may be dissolved. The "tincture of camphor," commonly called the "camphorated vinous spirit," is obtained by mixing one ounce of camphor with one pound of alcohol (sp. gr. 835), so that the camphor may be dissolved. It may be also made with double or triple the quantity of camphor. This spirit is too strong to be given internally; and if water be mixed with it, the camphor is separated. It is an useful stimulant and discutient application to chilblains, and in chronic rheumatism, paralytic numbness, and gangrene. See CAMPHOR.

SPIRIT of Carraway of the Lond. and Dub. Ph. is obtained by macerating a pound and a half (half a pound, Dub.) of carraway seeds bruised in a gallon of proof-spirit, and water sufficient to prevent empyreuma, for 24 hours, and distilling a gallon by a gentle fire. The *spirit of carraway* of the Edinb. Ph. is prepared by macerating half a pound of carraway seeds bruised in nine pounds of proof-spirit, for two days in a close vessel, adding water enough to prevent empyreuma, and distilling nine pounds. This spirit is an useful carminative, and an adjunct to griping purgatives. See CARUM.

SPIRIT of Cinnamon of the Lond. and Dub. Ph. is prepared by macerating one pound of cinnamon bark bruised in a gallon of proof-spirit, and water sufficient to prevent empyreuma, for 24 hours, and distilling a gallon by a gentle fire. The *spirit of cinnamon*, "spiritus corticis lauri cinnamomi," of the Edinb. Ph., is prepared with a pound of cinnamon bark, in the same manner as the spirit of carraway.

This

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This spirit is an agreeable cordial in diseases attended with much languor and debility. The dose is from fʒj to fʒiv, in any suitable vehicle. The official preparation is “infesum digitalis.” See CINNAMON.

SPIRIT, Coal. See COAL.

SPIRIT of Sulphuric Ether of the Lond. Ph. is obtained by mixing half a pint of sulphuric ether (see ETHER) with a pint of rectified spirit. The “sulphuric ether with alcohol,” of the Edinb. Ph., is prepared by mixing one part of sulphuric ether with two parts of alcohol. The specific gravity of this mixture is .816. It may be used for the same purposes as the ether, but it is much less active. The dose is from fʒj to fʒiij. An useful gargle for slight inflammation of the fauces is prepared by adding fʒj of this spirit to fʒvi of boiling water, sweetened with fʒiv of syrup of marsh-mallows. The sulphuric ether, of which this is an official preparation, is stimulant, narcotic, and antispasmodic. In its operation it resembles alcohol, but is more diffusible, and its effects are less permanent. It is beneficially employed as a cordial in typhoid and low fevers, particularly when nausea, subsultus tendinum, and other spasmodic symptoms are present. As an antispasmodic, it relieves the paroxysm of spasmodic asthma, whether it be taken into the stomach, or its vapour only be inhaled into the lungs; in which latter form it is also useful in simple dyspnoea and in catarrh. It is employed with advantage in hysteria, tetanus, cramp of the stomach, hiccough, and in cholera morbus to check the vomiting; and also allays the violence of sea-sickness. The usual dose of sulphuric ether is from fʒss to fʒij; but it has been given in much larger doses with the most beneficial effects; and in all cases, the dose must be repeated at short intervals, to produce the full effect of the remedy. As an external application, ether acts either as a stimulant or a refrigerant, according to the mode in which it is applied. The first takes place when it is prevented from evaporating, by being confined over the spot to which it is applied; in which case it often proves useful in relieving head-ache, and other muscular pains: and from its refrigerant effect produced by its rapid evaporation, it is applied to burns, and to assist in the reduction of strangulated hernia. It has produced, says Thomson (Lond. Disp.), almost immediate relief in ear-ache, when dropped into the external meatus.

SPIRIT of Ether, Aromatic, of the Lond. Ph., is obtained by macerating three drachms of cinnamon bark bruised, a drachm and a half of cardamom seeds powdered, long pepper powdered and ginger-root sliced, of each a drachm, in a pint of spirit of sulphuric ether, for 14 days, in a stoppered glass-bottle, and straining. The “aromatic sulphuric ether with alcohol,” of the Edinb. Ph., is made with the same aromatics, and in the same manner as the compound tincture of cinnamon, except that sulphuric ether with alcohol is employed instead of proof-spirit. The medicinal properties of these preparations are the same with those of the former; the aromatics rendering them in a slight degree more grateful.

SPIRIT, Ethereal, of Frobenius, Spiritus Etherius Frobenii, a name given by Frobenius, and others, to a liquor famous for its extreme volatility, and many other qualities; for which see Sulphuric ETHER.

The use of this liquor in medicine is now well known: as a very thin and volatile inflammable matter, it acts powerfully on the nervous system. Frederic Hoffman was one of the first who employed it as a sedative and antispasmodic. See LIQUOR Mineralis Anodynus, and SPIRIT of Ether, infra.

It is now often prescribed singly, in the dose of seven or

eight drops upon a bit of sugar, which is to be eat, or to be dissolved in some proper liquor, and drank. It is given in flatulent colics, obstinate hiccoughs, convulsive hysterical affections, and other disorders of this kind. This ether is said to take spots of grease from silk, without affecting their colours.

We have several curious observations on this ether of Frobenius by Mr. Grosse, who has described three different methods of making it in the Memoirs of the Academy of Sciences, for the year 1734.

SPIRIT of Ether, Compound, of the Lond. Ph., is prepared by mixing a pint of spirit of sulphuric ether with two fluid-drachms of ethereal oil. (See Sulphuric ETHER.) This is intended as a substitute for the anodyne liquor of Hoffman (see the preceding article); for, besides being stimulant and antispasmodic, it is supposed to possess anodyne properties. It is an useful addition to tincture of opium, when given for the purpose of procuring sleep; and it often prevents the opium from exciting the nausea which it is apt to produce in some habits. The dose is from fʒss to fʒij, in any appropriate vehicle.

SPIRIT of Juniper, Compound, of the Lond., Dub., and Edinb. Ph., is prepared by macerating one pound of juniper-berries bruised, carraway seeds and fennel seeds bruised, of each an ounce and a half, in a gallon (nine pounds, Edinb.) of proof-spirit, for 24 hours (two days, Edinb. and Dub.); and then distilling a gallon (nine pounds, Edinb.) by a gentle heat. This spirit is a grateful and useful addition to infusions of fox-glove, and other diuretics, in dropsy. See JUNIPERUS.

SPIRIT of Lavender. See LAVANDULA.

SPIRIT of Libanus, Smoking. See LIQUOR.

SPIRIT of Malt. See MALT-Distillery.

SPIRIT of Mindereus. See ACETITE of Ammonia, LIQUOR, and VINEGAR.

SPIRIT, Molasses. See MOLOSSRS-Spirit.

SPIRIT of Nitre. See NITRIC Acid, and Nitrat POTASSÆ.

SPIRIT of Nitric Ether of the Lond. Ph. is obtained by taking two pints of rectified spirit, and three ounces (by weight) of nitric acid. Add the acid gradually to the spirit, and mix them, taking care that the temperature, during the mixture, does not exceed 120°; then distil, by a gentle heat, 26 fluid-ounces. *Spirit of nitrous ether* of the Edinb. Ph. is prepared by pouring three pounds of alcohol into a large phial placed in a vessel full of cold water, and adding one pound of nitrous acid gradually, with frequent agitation. Slightly cork the phial, and place it in a cool place for seven days; then distil the liquor, by the heat of boiling water, into a receiver kept cool with snow or water, as long as any spirit comes over. The *nitrous ethereal spirit* of the Dub. Ph. is prepared in the following manner: Add to the matter which remains after the distillation of nitrous ether, the rectified spirit of wine, employed in that operation for condensing the elastic vapour, and distil to dryness, with the greater heat of a water-bath. Mix the distilled liquor with the alkaline liquor which remains after the separation of the nitrous ether, and also add as much dry sub-carbonate of kali as shall be sufficient to saturate the predominant acid; which is to be determined by the test of litmus. Lastly, distil by the medium heat of a water-bath, as long as any fluid comes over. The specific gravity of this liquor is to that of distilled water, as 850 to 1000. The spirit of nitric ether, as procured by the London or Edinburgh process, has an extremely fragrant odour, and a pungent acidulous taste. It is very volatile and inflammable, soluble in water and alcohol, and strikes a deep
olive

olive with solution of green sulphate of iron. See *Nitrous ETHER*.

Spirit of nitric ether is refrigerant, diuretic, and antispasmodic. It has been long known and used, under the title of "sweet spirit of nitre," as a grateful refrigerant, and for quenching thirst in febrile affections; for which purpose the dose is from ℥xx to ℥xl, given in a cupful of water, or any other appropriate vehicle. In larger doses it acts as a gentle stimulant to the stomach, relieving nausea and flatulence; and also determines to the kidneys, increasing the flow of urine; on which account it is advantageously prescribed as an auxiliary to other diuretics in dropical complaints. The dulcified spirit of nitre is added by drops to potions and juleps, till it has given them an agreeable acidity.

It is also much used by our distillers to give a vinosity to those spirits, whose natural flavour of that kind they have destroyed by the improper use of alkaline salts in the rectifications. Nothing can be more proper for this purpose than this spirit, as it really gives the brandy-flavour, and is not at all prejudicial to health, but very well falls in with the nature of the spirit, and promotes its medicinal properties as a diuretic, deobstruent, and lithontriptic.

It has been suggested, that the method of making it for this purpose is improveable, by using in the preparation a spirit of wine impregnated with some fine flavoured ingredient, which has not much oil, for acids do not readily mix where there is much oil.

In the preparation of this dulcified spirit of nitre, the longer it stands in digestion with the spirit of wine, the milder it grows; and by the same means also, the violently corrosive oil of vitriol may be so blunted, as to be rendered scarcely perceptible to the taste. In fine, it has been said that a *spiritus nitri dulcis* may be made, by a slow digestion, greatly superior to that commonly used, and of so fixed a nature, that it will not be subject to have its flavour fly off from the spirit with which it is mixed, any sooner than the native vinosity of brandy will of itself fly off from that spirit, as it always will in time. A proper care in the preparation of this acid might free the distillers from that troublesome necessity they are under of adding their spirit of nitre, just before they send their goods away, for fear the flavour should be lost before the spirit is wholly used, and so the sophistication be found out. There is no fixing any certain proportion in which the acid is to be mixed with the spirit, but in general it is best not to over-do it; for though it will give an agreeable vinosity to any tolerable clean spirit, the person will be much deceived who attempts to draw the bad flavour of a foul one by it. Shaw's Essay on Distillery.

Mr. Woulfe describes an apparatus by which *nitrous ether* (in the article under *ETHER*) may be expeditiously obtained by distillation, with the heat only occasioned by mixing together the nitrous acid and the spirit of wine. This distillation is performed in a matras with a high neck, to which is fitted a head with a spout, communicating with the receiver by means of a long tube. The vapours that are not condensed in this receiver, or in a bottle joined to a spout in its bottom, are conveyed from the receiver through a bent tube into spirit of wine contained in a bottle. If any vapours pass uncondensed through this spirit of wine, they are conveyed through another bent tube into more spirit of wine contained in another bottle. The liquor collected in the bottle annexed to the receiver, being slowly rectified with slaked lime, furnishes very fine ether. The spirit of wine in which the vapours were condensed, contains so much ether, that this fluid may be separated from the spirit by

adding water. This spirit of wine is by the operation changed into good dulcified spirit of nitre. Phil. Trans. vol. lvii. art. 59.

SPIRIT of Sal Ammoniac. See *AMMONIACAL Preparations*.

SPIRIT of Salt. See *MURIATIC Acid*.

SPIRIT of Sulphur, or of Vitriol. See *SULPHURIC Acid*.

SPIRIT of Turpentine. See *TURPENTINE*.

SPIRIT of Venus. See *ACETIC Acid*.

SPIRIT of Vinegar. See *ACETOUS Acid, and VINEGAR*.

SPIRIT of Vitriol. See *SULPHURIC Acid, and VITRIOL*.

SPIRIT of Wine. See *ALCOHOL and WINE*.

SPIRIT is also used for any incorporeal being, or intelligence. In which sense God is said to be a spirit, angels are spirits; and the devil is an evil spirit.

In this sense the human soul is also called a spirit, from its thinking and reflecting powers, which cannot be conceived to reside in any thing material. See *SOUL*.

F. Malebranche observes, it is extremely difficult to conceive what it is that should make the communication between the body and the spirit; for if the spirit have no material parts, it cannot move the body. But the argument must be false somehow or other; for we believe that God can move bodies, and yet do we not attribute any material parts to him.

SPIRIT, in *Theology*, is used, by way of eminence, for the third person in the Holy Trinity, called *the Spirit, the Holy Spirit, or Holy Ghost*.

Concerning the nature and even the personality of the Holy Spirit, very different opinions have been entertained by theological writers, both ancient and modern. It has been said, indeed, that no mention occurs of any difference of opinion on this subject, that attracted any notice, till after the commencement of the Arian controversy, and even till after the council of Nice. It has been also asserted, that even after the rise of the Arian controversy, many persons expressed themselves concerning the Spirit as if it had no proper divinity, at least of a personal nature, without censure; and that this could not have been the case, if it had been the uniform doctrine of the orthodox, that the Holy Spirit was a proper *divine person*, equal to the Son, or the Father. Clement, one of the apostolical fathers, makes no particular mention of the Holy Spirit. Ignatius, allowing his epistle to the Ephesians to be genuine, seems to have considered the Holy Spirit rather as a "power" than as a "person." Justin Martyr says but little concerning the Holy Spirit; nor is it easy to conclude what was his real opinion. But some have imagined that he regarded him as a created being, since he represents him as inferior to Christ. Irenæus seems to have considered the Holy Spirit as a divine influence, and no proper person; calling him, in reference to the words of Isaiah (ch. lxi. 1.), the unction. Athenagoras considered the Holy Spirit as an efflux from the Deity. Tertullian seems to have thought, that the Holy Spirit was derived from Christ, in the same manner as Christ was derived from God, that is, by a kind of prolation. Novatian, who was as orthodox in his notions with regard to the Trinity as any person in his age, could not believe in the divinity of the Holy Spirit, whom he represents as inferior to the Son, whom he also makes inferior to the Father. Lactantius is complained of for not mentioning the Holy Spirit, and for denying his personality. Dionysius of Alexandria is censured by Basil for not admitting the divinity of the Holy Spirit, and reducing him to the rank of a created being. Hilary also seems to have considered the Spirit as a divine influence. After the council of Nice, the sentiments and language of the fathers appear to have undergone a material change.

change. Athanasius contended strenuously and effectually, not only for the divinity of Christ, and his consubstantiality with the Father, but also in behalf of that of the Holy Spirit, whose divinity was denied by Macedonius. Being in Egypt when this heresy prevailed, he procured a synod to be called, at which he attended, and where the Holy Spirit was, for the first time, decreed to be consubstantial with the Father and the Son. Soon after this, the divinity of the Holy Spirit was more solemnly determined at a council held in Constantinople, and from that time it was decreed no less heretical to deny the divinity of the Spirit, than that of the Son.

At this time the doctrine of the perfect equality of the Spirit and the Son, as well as that of the Son and the Father, was fully established; and it was not long before the forms of public worship were accommodated to this opinion; for instead of the customary doxology of "Gloria Patri," Flavianus of Antioch made an alteration, for which purpose he is said to have assembled a number of monks, and to have first chanted out "Glory to the Father, to the Son, and to the Holy Ghost." Whereas, before his time, some had said "Glory to the Father through the Son, in the Holy Spirit," which was the most customary form; and others, "Glory to the Father in the Son, and the Holy Spirit."

The doctrine avowed and maintained by Athanasius, was supported by the influence of Basil, the two Gregories, Chrysostom, and Cyril of Alexandria. The latter says, "the Holy Spirit is the Spirit of the unbegotten God, and comes forth from him, has personality and life, and always exists, being from that which exists." At this time the doctrine of the inferiority of the Spirit to the Son, and of his having been created by him, was severely reprobated. Basil maintained, that to deny the divinity of the Holy Spirit, is to be guilty of blasphemy against the Holy Spirit; and Chrysostom observes, "it cannot be that he who halts with respect to the Spirit, can walk upright with respect to the Son." However, though it was admitted, that the Spirit was a divine person as well as the Son, and yet, like the Son, not absolutely underived, there was some difficulty in settling the mode of his derivation. At length, the term "proceeding" was adopted, as expressing the manner of the emission of the Spirit from the fountain of Deity, and was deemed to be different from that of "generation," which had been appropriated to the Son: nevertheless, the difference between the two terms could not be easily adjusted. Austin says that the Holy Spirit, being the Spirit both of the Father and the Son, proceeds from them both; and this he makes to be the difference between the generation of the Son and the procession of the Spirit. Cyril of Alexandria thought that he had some idea of the nature of the procession of the Spirit from the substance of God, when he says, that "Christ breathed upon his disciples, to shew that the Holy Spirit proceeds from the divine substance, as the breath of man proceeds from him."

In proof of the divinity of the Holy Spirit it has been alleged, that divine names, titles, attributes, works and worship, are or seem to be ascribed, in various passages of scripture, to the Holy Spirit. Many plead that the Holy Spirit is called Jehovah in the Old Testament, by comparing Acts, xxviii. 25. with Isaiah, vi. 9; and Heb. iii. 7—9. with Exod. xvii. 7; Jer. xxxi. 31—34. with Heb. x. 15, 16. In adverting to the first of these cited passages, in which the words spoken by God to Isaiah are by St. Paul said to be spoken by the Holy Ghost, it has been concluded, that God and the Holy Ghost are one and the same individual person. But in Rev. xi. 43, an inferior angel is introduced as speaking in the person of God, and therefore this mode of

reasoning has not been allowed by the opposers of this doctrine. It is alleged further, that the Holy Spirit is, probably, called God v. 4, to which passages some add 1 Cor. iii. 16. vi. 19. 2 Cor. iii. 17. Moreover, divine perfections are said to be ascribed to the Spirit of God; particularly omniscience, 1 Cor. ii. 10, 11. Is. xl. 13, 14; to which some add 1 John, ii. 20; — omnipresence, Pf. cxxxix. 7. Eph. ii. 17, 18. Rom. viii. 26, 27; — omnipotence, Luke, i. 35. 1 Cor. xii. 11; — eternity, Heb. ix. 14. Again; divine works are ascribed to the Spirit, Gen. i. 2. Job, xxvi. 13. xxxiii. 4. Pf. xxxiii. 6. civ. 30, &c. Some persons likewise add those texts in which miracles, inspiration, and saving operations upon the heart of man, are ascribed to the Spirit. The chief texts produced to prove that divine worship is given to the Spirit are, Is. vi. 3. compared with v. 9, and Acts, xxviii. 25, &c. Rom. ix. 1. Rev. i. 4. 2 Cor. xiii. 14; and above all, Matth. xxviii. 19. Upon the whole it is alleged, that the blessed Spirit is spoken of in such a manner, as it cannot be imagined would be used in speaking of a mere creature, and, consequently, must be possessed of a nature properly divine. On the other hand it is maintained, that the proofs taken from the attributes and operations of the Spirit are of no more force than in the case of the Son's supreme deity; both Son and Spirit, being agents under God at his will, are concerned in his glorious works, and partakers of his power and wisdom; so that it is no wonder if most of these be ascribed to the Spirit, but still as to one sent of God. Moreover, these arguments bear less evidence in relation to the Holy Spirit, because of the different ideas which the word Spirit stands for. The Spirit, and Holy Spirit, very often signify not a personal Spirit, but the attributes and operative efficacious virtue of God, the energy of his power, wisdom, and holiness, exerted in powerful operations, afflatus, and inspiration. The name of God is never once given to the Spirit, nor is direct worship or invocation, prayer or praise, glory or dominion, once given to him, in precept or practice, in the New Testament; though his communications are wished and prayed for to Christians, 2 Cor. xiii. 14.

The chief controversy on this head is, whether the spirit of God be a person in the *philosophical sense*, or merely a divine power or energy. That he is a person, is argued from his being described as having understanding, 1 Cor. ii. 10, 11; willing, 1 Cor. xii. 11; speaking and sending messengers, Is. vi. 8, compared with Acts, xxviii. 25. viii. 19. x. 19, 20. xiii. 1—4. 1 Tim. iv. 1; as Dr. Barrow interprets it, sending Christ, Is. xlvi. 16; as pleading, Rom. viii. 26; as being grieved, Is. lxiii. 10. Eph. iv. 30; as teaching and reminding, John, xiv. 26; as testifying, John, xv. 26; as reproving, John, xvi. 8, &c.; as executing a commission received from God, John, xvi. 13, 14.

Among those who grant the Spirit to be a person, it is debated whether he be the same philosophical person with the Father, or another distinct from him; to suppose the latter (supposing him at the same time equal with the Father) is making him *another God*. Some, therefore, have represented him as a created Spirit, in his own nature inferior both to Father and Son; against which the passages above enumerated have been strongly urged; as it has also been, that the Spirit is never mentioned as a creature called upon to praise God, when a large enumeration of such is made. Others consider him as a created Spirit, (called as one thinks Michael the archangel), so united to God, and so actuated by him, as by virtue of this union to become capable of such representations and regards as the Son is, though acting in some subordination to him in the economy

of our redemption;—while many others have contented themselves with asserting, that there is only a *political, modal, or economical* distinction, in the personality of the Father, Son, and Spirit. Others again have maintained, that the Spirit is a third distinction in the Deity; and when he is called a *person*, the word is to be taken in such a sense below the philosophical and above the modal; though what determination is to be affixed to it, they do not more particularly say.

Those, and they form a numerous class, who assert the Spirit to be a divine *power*, plead chiefly the sense of the word in the Old Testament, where they say it has generally that signification: and that it would be absurd to suppose, that the idea should be so greatly changed, when Christ and his apostles addressed those who had been bred up in the Jewish religion, and must, therefore, have been used to conceive of the Spirit according to the representation made in their sacred oracles. It is also pleaded, that the *pouring out one person on another*, is both unscriptural and unintelligible language, but not so, if it relates to a divine *power*, influence, or operation. They urge in favour of the explication of the doctrine, Luke, i. 35; and reply to the passages of scripture above cited, by observing, that nothing was more common among the ancients, and more especially the Eastern nations, than to represent powers, properties, and attributes, by personal characters; thus, wisdom is represented as contriving, rejoicing, inviting, pleading, reproving, &c. Prov. i. 20, &c. iii. 13, &c. iv. 6, &c. viii. 1. ix. 1, &c.; charity, as believing, rejoicing, &c. 1 Cor. xiii.; and death, as being plagued, Hof. xiii. 4; the scripture, as foreseeing and preaching, Gal. iii. 8; the sun, as rejoicing, Ps. xix. 5; a famine, as coming at God's call, 2 Kings, viii. 1; righteousness, as walking before him, compare Ps. lxxxv. 10—13; and the wind, as willing, John, iii. 6. To those who allege these passages, it is replied, that none of them come up to the preceding texts; more especially considering how frequently the personal term *εἶδος* is used, when spoken of the Spirit, and that not merely in poetical, but most plain and simple discourses, which, indeed, as it might be argued, is necessary to render the personification complete; but the strongest objection against this opinion is said to arise from the form of baptism, and the fore-mentioned John, xvi. 13, 14.

Dr. Lardner examines the different senses in which the words Spirit, Spirit of God, and Holy Ghost, are used in the Old and New Testament; and he finds, 1. That Spirit is in many places equivalent to God himself. 2. That it often means the power or wisdom of God, or his will and command. 3. That it often means an extraordinary gift from God of power, wisdom, knowledge, and understanding. In Heb. ii. 14. gifts of the Holy Ghost should be distributions of the Holy Ghost; an expression plainly declaring, that by the Holy Ghost or Holy Spirit were meant those spiritual gifts, which came down upon men from heaven immediately, or were communicated in great variety by laying on the hands of the apostles. 4. In the epistles of the New Testament, there are at the beginning and elsewhere wishes of peace from God the Father and the Lord Jesus Christ, but none from the Spirit distinctly; nor are there any doxologies or ascriptions of glory to the Spirit distinctly, though there are several such ascriptions to God and Christ, or to God through Christ.

But it may be said, as our learned and impartial author states the objections of those who maintain a different opinion, that the Spirit or the Holy Ghost is oftentimes spoken of as a person, and especially in St. John's gospel. To which he replies, 1. It is not uncommon in the language of

scripture, as we have already stated at large, to personize many things to which we do not ascribe intelligence; thus, *e. g.* wisdom is personified in the book of Proverbs, and sin and death in the New Testament. 2. There is not in the Acts of the Apostles, or in any other book of the New Testament, any account of the appearance and manifestation of a great agent or person after our Saviour's ascension; therefore no such thing was promised or intended by our Saviour, nor expected by his apostles, who could not but know his meaning. 3. In other texts of scripture, and particularly in St. John's gospel, by the Spirit or Holy Ghost is meant a gift, or plentiful effusion of spiritual gifts. 4. Our Saviour himself explains what he meant by the Comforter, *i. e.* the divine influence or effusion of spiritual gifts. 5. Our blessed Lord, in speaking of this matter, has made use of a variety of expressions, by attending to which we may clearly discern his true meaning, in what he says of the Comforter. All which seem to shew, that by the Spirit is to be understood that special influence, which, in different measures and proportions, God vouchsafes to men through Jesus Christ for their own comfort and establishment, and for spreading the great truths of religion in the world. This power or divine influence, this effusion of knowledge and other spiritual gifts, our Lord calls the Comforter or the Advocate, *παρακλητος*, as thereby their cause would be pleaded with men, and they would be justified in preaching boldly in the name of Jesus Christ. This gift, this divine influence, he calls also the spirit of truth, because by this wonderful influence on their minds, the apostles would be led into the knowledge of all the truths of the Gospel, and would be enabled to teach them to others with perspicuity. And our Lord speaks of the Spirit's bringing to their remembrance the things which he had said, and of his receiving of his and shewing it unto them; because by his miraculous influence upon their minds, those prejudices would be removed, which had obstructed their clear discernment of what Christ had said unto them, when he was with them. By the Holy Ghost in Matth. xxviii. 19, where we have the form of baptism, we are to understand the miracles of our Saviour's ministry, and likewise the miracles wrought by his apostles, and the spiritual gifts bestowed upon the apostles and other disciples of Jesus, and all believers in general, soon after our Lord's ascension, and all the miraculous attestations of the truth, and divine origin of the doctrine taught by Jesus Christ. On the subject of this article, we refer our theological readers to Calamy on the Trinity, Sermon vi. Emlin's Tracts, vol. ii. Burnet on the Art.—Script. Doctr. of the Trin. Diss. v. Watts on the Trin.—Also, Christ. Doctr. of Trin. Barrow's Works, vol. ii. Clarke on the Trin. part i. ch. 3. part ii. § 3, 4. 19, 20, 21, 22. 28—32. 40—42. 45, 46. 53. Taylor on the Trin. part iii. Owen on the Spirit, l. i. c. 3. Pearson on the Creed. Dr. Scott's Ess. towards a Demonstr. of the Script. Trin. prop. iii. Lardner's First Posit. to the Letter on the Logos, apud Works, vol. xi. Priestley's Hist. of Early Opinions, vol. ii.—Corruptions, vol. i. Doddridge's Lectures.

SPIRIT, Order of the. See *HOLY Ghost*.

SPIRIT is also used, among *Divines*, for the divine power and virtue, and the communication of it to men.

In this sense, the spirit is said to have gone out on the face of the deep (Gen. i. 2.), and the prophets to have been possessed with the spirit of God. Providence, in this sense, is that universal spirit by which God makes all nature to act.

Thus, the holy Virgin is said to have conceived of the Spirit.

SPIRIT, *Private*, is a term that made a great figure in the controversies of the two last centuries. It signifies the particular sense or notion each person has of the dogmata of faith, and the truths of religion, as suggested by his own thoughts, and the persuasion he is under with regard to them.

The first reformers denying strenuously any infallible interpreter of the scripture, or any settled judge of controversies, maintained, that every person was to interpret and judge of revealed truths by his own light, assisted by the grace of God; and this was what they called *private spirit* or *judgment*.

Against this, the arguments used by the Romanists are, that revealed truths being one and the same for all believers; the rule God has given us for judging of them, ought to represent them to us uniformly, and the same; but the private spirit informs Luther one way, and Zuinglius another. It divides Oecolampadius, Bucer, Osiander, &c. And the doctrine it discovers to the Confessionites, is quite different from that it shews the Anabaptists and Menonites, in the very same passage of scripture.

SPIRIT, *Spiritus*, is also used, in *Prosody*, to signify the greater or less degree of breath employed in the pronunciation of the initial Greek vowels, and of the letter ρ.

In sounding the vowels, we may observe every vowel has its sound by a simple conformation of the mouth, in which the breath has little or no concern, as being confined in the arteria aspera: the spirits, or breaths, which are placed on the initial vowels in words, are to denote the force this initial vowel is to have from the breath, when the word is pronounced. If the sound of this vowel be smooth, as all the sounds of the vowels naturally are, this is termed *spiritus lenis*, a mild breath; but if this vowel be to be pronounced with a more vehement expulsion of the air, this is termed *spiritus asper*, or a rough breath, or aspirate: and when the aspirate and acute are in the same syllable, the mark of the breath, in this initial vowel, only signifies, that the vowel is to be pronounced with a stronger breath than the initial mild vowels; for aspirates do not alter the tone of any syllable, but only strengthen, increase, and swell the tone.

SPIRIT-LEVEL. See **LEVEL**.

SPIRIT-ROOM, in *Ship-Building*, a secure apartment built next abaft the after-hold, to contain the spirits. See **SHIP-BUILDING**.

SPIRITOSO, *con Spirito*, Ital., in *Music*, severally imply animation, spirit, and fire, in the performance of the movements to which either of these terms is prefixed.

SPIRITU SANTO, or *Espiritu Santo*, (which see,) in *Geography*, a sea-port of Brazil, in the government of Rio Janeiro, situated on the south side of a large bay, about three leagues from the ocean, but having neither walls nor fortifications, except a small ruined castle; so that its defence consists in the bravery of its inhabitants, who amount to about 900. The port is a small bay, opening to the east, and intersected with many small islands. At the top of a mountain, at some distance from the town, is a large white tower, which the Portuguese call Nossa Senhora de Pena, and near it a small church, surrounded with a wall. At the foot of the mountain are still to be seen a few old houses, the melancholy remains of a place once called Villa Veja, or the Old City. S. lat. 20° 8'.—Also, a town of the island of Cuba; 155 miles E.S.E. of Havannah. N. lat. 22° 15'. W. long. 79° 47'.—Also, a town of Peru; 8 miles W. of Potosi.—Also, a town of Chili; 60 miles from Coquimbo.—Also, a river of Mexico, which runs into the Pacific ocean, N. lat. 23°. W. long. 106° 40'.—Also, a town of Mexico, in the province of Mechoacan;

65 miles E.N.E. of Zacatula.—Also, a river of Brazil, which runs into the Atlantic, S. lat. 20° 10'.—Also, a lake of East Florida, near the southern extremity.

SPIRITU SANTO Bay, called also Tampay bay, and Hillborough bay, a large bay on the west coast of East Florida. N. lat. 28°. W. long. 82° 45'.

SPIRITU SANTO Islands, or *Andros*, a chain of islands, situated to the south-west of the Bahamas; the largest about 40 miles in length, and eight in breadth. N. lat. 24° to 25° 12'. W. long. 77° to 78° 15'.

SPIRITUAL FRIARS. See **FRANCISCANS**.

SPIRITUALITIES of a bishop, are such profits as arise to him from the benefit of his jurisdiction in his diocese, and not as a baron of parliament.

Such are those of his visitations, institutions, ordinations, presentation-money, &c.

SPIRITUALITIES, *Guardian of the*. See **GUARDIAN**.

SPIRITUALIUM CUSTOS. See **CUSTOS**.

SPIRITUALIZATION, in *Chemistry*, the action of extracting spirits from natural bodies. See **SPIRIT**.

Spiritualization is an operation that belongs principally to fermented salts, and then to fermented juices and liquors; the fermentation rendering the spirits volatile and inflammable.

Spirit of wine is sometimes spiritualized to that degree, that upon throwing a quantity into the air, not a drop shall fall down; but the whole evaporate, and be lost.

SPIRITUS. See **SPIRIT**.

SPIRKET, in *Rural Economy*, a term applied to a hook to hang any thing upon, as the cart-geer, &c. in stables and other places.

SPIRKETTING, in *Ship-Building*, a thick strake, or strakes, wrought withinside upon the ends of the beams or water-ways. Spirkettings under ports reach from the water-ways to the upper side of the lower fill, which is generally of two strakes, wrought top and butt.

SPIRTING CUCUMBER, in *Botany*, a species of *momordica*; which see.

SPISE, in *Geography*, a town of Africa, in the kingdom of Ningo, in the interior part of the Gold Coast.

SPISSUM, in the *Ancient Music*, was used to signify those two smaller conjunct intervals of a tetrachord, which, taken together, were less than the third.

The Greek term for this was *σπυρισμ*. This happened in the enharmonic, and the three chromatic genera; in each of which, the interval between the hypate and the lichanos, was less than the interval between the lichanos and the nete. To the spissum was opposed the non-spissum, *ἀσπυρισμ*, or *rarum*, as Martianus Capella translates it. The *σπυρισμ* happened in the two diatonic genera, where the two smallest intervals were equal to, or greater than the third. They were supposed equal in the diatonicum molle, and greater in the intenfum. See **GENUS**.

SPIT, *The*, in *Geography*, a shoal of the Atlantic, near the coast of South Carolina; 15 miles S. of Cape Fear. N. lat. 33° 34'. W. long. 78° 10'.

SPIT, in *Agriculture* and *Gardening*, the quantity or depth of earth or mould which the spade takes up at once in digging or delving over ground. Thus, this sort of work is performed to one, two, or more spits deep, according to circumstances, and the nature of the soil and crops.

SPIT-DUNG, that sort of dung manure which has undergone complete fermentation or putrefaction, and is reduced into a somewhat earthy state, so as to be dug or taken up by the spade or shovel in a sort of spit manner.

SPIT-SHOVEL, that sort of tool of the shovel kind which is employed in digging out or shovelling up such dung, or

other matters, as are in a reduced earthy condition. And the term is also sometimes applied to it when used in taking up grain for the purpose of having it cleaned or removed into another situation.

SPITAL, in *Geography*, a town of Austria; 6 miles S. of Steyr.—Also, a town of Spain, in Catalonia, near the coast of the Mediterranean; 22 miles N.E. of Tortosa.—Also, a town of the duchy of Stiria; 5 miles E. of Muertzenfchlag.—Also, a town of the duchy of Carinthia, on the Lifer, about a mile from the Drave; 8 miles E. of Saxenburg.

SPITHEAD, a spacious reach in the British Channel, about mid-way between the southern coast of Hampshire and the Isle of Wight. It directly faces the mouth of Portsmouth harbour, and is frequently occupied by men-of-war and frigates at anchor. Sometimes a fleet of ships is stationed here. It is said that 1000 sail of vessels may anchor at one time with security. The depth of water, at low tide, is 10, 11, 13, 14, 15, and 16 fathoms. This place is memorable for the shipwreck of the Royal George, of 100 guns, in August 1782. At that time the vessel was occupied by more than 400 men and 200 women, and was hove on one side, for the purpose of repairing her keel. Not anticipating danger, the sailors had neglected to lash down her lower deck ports, and a sudden squall coming on, she was thrown with her broad-side on the water. The hole was filled in a few minutes, and every thing was carried to the bottom. Admiral Kempenfelt, with all the crew and visitors, perished; for there was no time for boats to afford assistance. Many attempts have been made to raise this vessel, but without success; although many articles have been obtained from the cabins, &c. Some of the malts continued to be seen above water for many years after the accident.

SPITHEAD Creek, a river of the western territory of America, which runs into the Ohio, N. lat. 39° 56'. W. long. 80° 46'.

SPITTER, among *Sportsmen*, a red male deer near two years old, whose horns begin to grow up sharp and spittlewise.

It is otherwise called a *brocket* and *pricket*.

SPITTLE. See SALIVA and SPUTUM.

SPITTLE, a corruption of the word *hospital*.

SPITTLE, in *Agriculture*, the name of a spaddle or small sort of spade. See SPADE.

SPITTLING, a term applied to an operation performed in the cultivation of teale crops, in which the workman, with a tool of the spittle, shoe, or small spade kind, turns over the surface-mould between every plant in a careful manner, in the first summer season after planting, when the plants have acquired some degree of growth. By this means they are kept perfectly clean from weeds, and their growth promoted as much as possible.

The work commonly costs about a guinea and a half the acre and drink, in most districts where this sort of cultivation is carried on. See TEASLE.

SPITZ, in *Geography*, a town of Austria, on the Danube; 10 miles above Krens.—Also, a town of Bohemia, in the circle of Leitmeritz; 9 miles N.E. of Kamnitz.

SPITZBERG, a considerable mountain of Silesia, in the principality of Liegnitz.

SPITZBERGEN, or SPITSBERGEN. See East GREENLAND.

SPITZEBACH, a river of Germany, which runs into the Eltzach, near Ober Winden.

SPIZA, in *Ornithology*, a name by which the ancient naturalists called the chaffinch.

SPLA-BOARDS, in *Ship-Building*, boards or planks fixed

to an obtuse angle in the light-room, to throw the light into the magazine.

SPLACHNUM, in *Botany*, a name adopted by Montin and Linnæus from Dioecorides, whose *σπλαχχιον* is synonymous with his *βρυον*, and belongs to the Mosses in general, or rather perhaps Lichens, which grow upon trees. This name becomes peculiarly appropriate, when we advert to its identity with *σπλαγγχιον*, the Greek appellation of the principal *viscera*, the heart, lungs, &c.; because the essential character of the genus before us consists in a peculiar fleshy glandular organ, supporting the capsule; whence its English name, Gland-moss.—Montin Diff. 7. Linn. Am. Acad. v. 2. 270. t. 3. Gen. 563. Schreb. 759. Hedw. Fund. v. 2. 88. t. 7. f. 33. Sp. Musc. 51. Sm. Fl. Brit. 1169. Turn. Musc. Hib. 15. Swartz Musc. Suec. 22. Juss. 11. Lamarck Illustr. t. 874.—Class and order, *Cryptogamia Musci*. Nat. Ord. *Musci*.

Ess. Ch. Capsule cylindrical, placed on a fleshy receptacle. Fringe simple, of sixteen teeth, standing in pairs.

This genus is one of the most remarkable of its tribe for size and beauty, as well as for singularity. Twelve species are defined in Hedwig's *Sp. Musc.*; thirteen in the *Fl. Brit.* six of the latter not being known to Hedwig. Linnæus, in the original account of the genus, describes but two, which are far the most extraordinary, natives of the most northern part of Europe, and not found in Britain. We shall describe these, with a few of the others best worth notice.

S. muscioides. Green Tapering Gland-moss. Linn. Fil. Meth. Musc. 26. Hedw. Sp. Musc. 51. Crypt. v. 2. 35. t. 11. Fl. Brit. n. 1. Engl. Bot. t. 1589.—Receptacle inversely conical, green. Leaves elliptic-lanceolate, bearded, entire.—Native of moist alpine situations in Scotland, Wales, and other parts of Europe, generally, in Wales, growing on the dung of foxes and badgers, according to Mr. Griffith's remarks. This is one of the smaller species, resembling some common *Bryum*; its leafy stems about an inch high; its fruit-stalks rather more. The capsule is cylindrical, brown, with a blunt lid. Its short green receptacle at the base might almost be overlooked, as a swelling of the stalk.

S. sphaericum. Green Globular Gland-moss. Linn. Fil. Meth. Musc. 33. t. 1. f. 1. Hedw. Sp. Musc. 55. Crypt. v. 2. 46. t. 16. Fl. Brit. n. 8. Engl. Bot. t. 785.—Receptacle globular, green. Leaves ovato-lanceolate, pointed, entire. Fruit-stalk capillary.—Native of alpine situations in Lapland, Germany, Carniola, Scotland, &c. usually on cow-dung. Dr. F. Buchanan first met with it at Leney near Stirling, in 1782. This forms green tufts, each plant being simple, apparently annual, about half an inch high in the leafy stem, which terminates in a stary blossom. Some of these blossoms are most perfectly male, others female. The latter produce each an elegant slender wavy tawny fruit-stalk, from one and a half to three or four inches high, bearing a green, nearly globose, smooth receptacle, much larger and thicker than the little brown cylindrical capsule, bordered with eight pair of spreading brown teeth.

S. gracile, Dickf. Crypt. fasc. 4. 3. t. 10. f. 5. Fl. Brit. n. 9. Engl. Bot. t. 1921, is supposed by Mr. Turner to be a variety of the last, rather smaller, with ferrated points to the leaves, and a brown receptacle.

S. ampullaceum. Purple Gland-moss. Linn. Sp. Pl. 1572. Hedw. Sp. Musc. 55. Crypt. v. 2. 41. t. 14. Fl. Brit. n. 10. Engl. Bot. t. 144. Fl. Dan. t. 822. (S. n. 3; Linn. Am. Acad. v. 2. 280. Bryum ampullaceum, foliis thymi pellucidis, collo striatioribus; Dill. Musc. 343. t. 44. f. 3.)—Receptacle inversely conical, ob.ule, greenish-purple, thrice as thick as the capsule. Leaves lanceolate, acute, ferrated.

ferrated.—One of the most common species, at least in England, growing chiefly on rotten cow-dung on moist turfy heaths in the spring, ripening fruit in summer. It seems no less frequent in other parts of Europe. This is larger than *S. sphaericum*, annual like that, but distinguished by the narrower ferrated leaves, stouter stalks, and especially the large purple pear-shaped receptacles, each crowned with a little slender tawny capsule.

S. Turnerianum, Dickf. Crypt. fasc. 4. 3. t. 10. f. 11. Fl. Brit. n. 11. Engl. Bot. t. 1116, is, we fear, but a small, or starved, variety of the last.

S. vasculosum. Crimson Globular Gland-moss. Linn. Sp. Pl. 1572. Hedw. Sp. Musc. 53. Crypt. v. 2. 44. t. 15.—Receptacle blood-red, nearly globular. Leaves spatulate, bluntnish, entire.—Native of turfy bogs near Upsal, and in other parts of Sweden. About the height of the last, but distinguished by its blunt entire leaves, and the globular form, greater size, and deep rich hue of its receptacle. This fine species has also been found in Germany, but not in Britain.

S. rubrum. Red Umbrella Gland-moss. Linn. Sp. Pl. 1572. Hedw. Sp. Musc. 56. Crypt. v. 2. 51. t. 18. (S. n. 1; Montin Diff. 8. t. 1. f. 2. Muscus norwegicus, umbraculo ruberrimo insignitus; Petiv. Musc. 11. t. 1. f. 70. Dill. Musc. 547. t. 83. f. 9.)—Receptacle orbicular, convex, red. Leaves ovate, partly toothed.—Native of Norway, Finland, Russia, and most parts of Siberia. The stem, like most of the rest, is simple, leafy, about an inch high. Upper and floral leaves ferrated. Fruit-stalk about six inches long, erect, red, bearing a small cylindrical capsule, which is subtended by a most beautiful, large, and conspicuous receptacle, like an inverted cup, half an inch wide, of a rich crimson, finely reticulated, and certainly one of the most curious productions in this whole natural order.

S. luteum. Yellow Umbrella Gland-moss. Linn. Sp. Pl. 1572. Hedw. Sp. Musc. 56. Crypt. v. 2. 48. t. 17. (S. n. 2; Montin Diff. 9. t. 1. f. 1.)—Receptacle orbicular, flattish, deflexed, yellow. Leaves obovate, entire.—Native of boggy woods in Lapland and Westbothland. This vies with the last in magnitude and singularity, but the receptacle is pale yellow, and though deflexed, scarcely convex. By Hedwig's figures, as well as the Linnæan specimens, this part seems to be small and green till the capsule is fully formed, after which it expands and assumes its proper colour.

SPLAIT-SHOULDER. See SHOULDER.

SPLANCHNICA, a name given to medicines appropriated to diseases of the bowels.

SPLANCHNOLOGY, formed from *σπλαγχνον*, intestine, and *λογος*, discourse, in Anatomy, a discourse on, or explication of, the viscera.

Sarcology is divided into three parts, viz. splanchnology, myology, and angiology; of these, splanchnology is that which treats of the internal parts, and particularly of the viscera.

SPLEEN, in Anatomy and Physiology, (*σπλιν*, lien, *la rate*;) a body about the size of a small fist, of a texture rather resembling that of glands, situated in the left hypochondriac region of the abdomen, between the great end of the stomach, and that portion of the diaphragm which lines the concavity of the tenth and eleventh ribs.

The organ is usually single; but occasionally one, two, or more small secondary spleens (*lienes succenturiati*), of a round or oval figure, about the size of hazel-nuts, of a texture exactly similar to the principal one, are found near its anterior end, in the great omentum, connected by the latter and by their blood-vessels to the principal spleen.

It has been asserted that the spleen has been in some cases entirely deficient. It may have been greatly diminished by disease, or consumed by suppuration; but we have no sufficient testimony of its entire absence as a defect of original formation.

Every thing belonging to the spleen is irregular, and its figure is remarkably so. Usually the outline described by its circumference is elliptical: it represents, indeed, on the whole, the section of an ellipsoid carried through the axis. Its largest surface is convex, like the superficies of an egg; the margin oval, with two ends, and a longer and shorter axis. The convex surface of the organ, then, is the most extensive, rising in the middle, and sloping towards a comparatively thin edge: this is rather broader towards the back part, and grows narrower, terminating in an obtuse point in front. The opposite aspect is concave, and divided into two surfaces by a slight notch running along its long axis, at which the blood-vessels enter, and to which the omentum is affixed. Both ends of the spleen are obtuse: the posterior or superior is thicker, the inferior or anterior thinner. Sometimes the spleen is more rounded, or more triangular. Often the edge is notched in one or more places, and more or less deeply.

The situation of the spleen varies, as well as its figure. We may, however, state generally, that in a healthy subject of the ordinary formation, it will be found in the upper and back part of the left side of the abdomen, covered by the false ribs, lying between the back of the great end of the stomach and the diaphragm in such a way, that it is not visible on opening the abdominal cavity until the stomach is drawn aside. Its convexity corresponds to the concavity of the diaphragm, and of the tenth and eleventh ribs; its concavity to the great end of the stomach: one end is turned backwards; the other forwards.

In this situation it is closely tied to the stomach by its blood-vessels, which send branches to that organ; and by the great omentum, which is attached to its notch, and to the neighbouring portion of the stomach. There are, besides, certain folds of peritoneum, connecting it to the surrounding parts. One of these, *ligamentum verticale*, or *suspensorium lienis*, or *phrenico-splenicum*, passes from the lower part of the diaphragm to the upper end of the spleen. Another, *ligamentum mesocolicum*, or *gastro-splenicum*, passes from the mesocolon, stomach, and œsophagus, to the posterior part of the notch. A fold of peritoneum may also be seen going from the spleen to the left renal capsule and kidney.

The changes of place in the stomach are attended with corresponding alterations of the spleen. When the former is full, the spleen is situated nearly transversely, with one end turned backwards, and the other forwards, with its concavity touching the colon in front, and the renal capsule behind. As the stomach becomes empty, the position of the spleen is more perpendicular; with its ends upwards and downwards. The motions of the diaphragm are necessarily accompanied with change of position in the spleen. When that muscle descends, it pushes the stomach and spleen downwards and forwards, thrusting them from under the ribs; they are brought back again to their former place by the re-action of the abdominal muscles.

When it is enlarged, it passes out of the hypochondrium, and can be felt in the umbilical region, or even the hypogastric: it has descended as low as the groin or bladder. In cases of transposed viscera, it has partaken the inversion with the other thoracic and abdominal organs.

The size of the spleen, like other circumstances belonging to this organ, is subject to much variety. Soemmerring states

states its weight at from six to fifteen ounces; and its specific gravity to that of water, as 1060 to 1000. It has been asserted, that the kind and the circumstances of death influence the size of the spleen; and we may readily believe that a part of spongy texture, containing so much blood, will be smaller in an individual who has perished from hæmorrhage than in one who has died of apoplexy. All physiologists have represented that the size of the spleen is influenced by the state of the stomach, which they conceive to act on it in two ways. They suppose that the full stomach presses the spleen against the ribs, and thus mechanically forces out the contents of its cells, which are expanded again as soon as this pressure is removed. It has been also imagined, that when the stomach is full of aliment, blood passes in larger quantity into its vessels, which admit it more easily; while, in the empty stomach, the vessels fall into folds, and do not receive so much blood. In the former case, the blood which goes to the stomachic arteries is partly drawn away from the splenic vessels, which also admit it less readily, because the spleen is at the same time compressed: in the latter, these circumstances are just reversed. These observations seem purely hypothetical; and they present a mechanical solution of vital processes, which are certainly governed by other principles. Not a single fact is adduced as a foundation of this fanciful superstructure. It seems, on the contrary, that there are facts sufficient to overturn it. "Numerous comparative experiments," says Bichat, "made at different points of time in the digestive process, during the plenitude and emptiness of the stomach, on animals of similar size, and under similar circumstances, have shewn, indeed, sensible variations in the volume of the spleen, but not that invariable coincidence, which has been asserted, between the contraction of the stomach and the increase of the spleen, and *vice versa*. The opposite relation was often noticed; so that we could only conclude, that the differences of volume were independent of the succession of the digestive phenomena, and constituted permanent peculiarities of individual organization. The kidney, the liver, &c. do not exhibit an uniform size in all subjects; but we do not trouble ourselves by endeavouring to find causes for such variations.

"Lastly, admitting that the volume of the spleen varies during life, whether these variations coincide or not with determined states of the digestive organs, it is repugnant to the spirit in which modern physiology contemplates the phenomena of life, to assign the laxity of the spleen, when the stomach is empty, as a cause for the derivation of blood from the vessels of the latter organ, or its mechanical compression by the distended stomach, as a means of explaining the more rapid passage of the blood into the system of the vena portarum." *Anatomie Descriptive*, t. v. p. 58.

We cannot doubt, that, independently of disease, or of such natural causes as may produce changes in the state of the spleen, the volume of this organ is different in different individuals. Animals of the same species and age, and under circumstances in all respects similar, exhibit such differences. We frequently, too, find the spleen after death, in the human subject, considerably larger or smaller than what may be regarded as the standard size, though alike in all other points; so that the kind of death, or other accidental circumstance, will not explain the difference.

The colour of the spleen is red or livid, or of some tint between these. The convex surface is often red, while the edge and concavity are livid. The former colour is more prevalent in young, the latter in old subjects. When the organ is cut, its internal colour seems to depend on the large quantity of blood it contains; and nearly resembles

that of a coagulum, with divided blood-vessels interspersed through it.

It is spongy, soft, and delicate in its texture, so that it can be broken down by moderate pressure with the fingers.

The spleen is surrounded externally by a smooth, thin, and closely-adhering serous membrane, derived from the peritoneum. This coat is so intimately united to the next, that they cannot be separated. The proper membrane immediately incloses the spleen. Although this and the former are inseparably united, we cannot doubt that such a proper membrane exists, because the covering is much thicker than the peritoneum in any situation. Just at the notch, the peritoneum may be separated for a short distance from the proper membrane. From the internal surface of this covering, numerous fine filaments are continued into the substance of the spleen, where they form part of the peculiar tissue of the organ. The proper membrane is so thin, that its nature is not easily ascertained: it seems, however, to belong to the fibrous class, as it is corrugated by boiling, and easily receives depositions of gelatine, or phosphate of lime. Thickenings of the splenic coats from this cause are very common. This membrane is softer than those of the fibrous kind usually are; and it is elastic, so as to accommodate itself to the varying bulk of the organ.

The spleen is remarkable from the size of its artery, which is larger in proportion to the organ than in any other instance, although no secretion takes place. There are great varieties in the number of secondary branches, by which it penetrates the notch of the spleen. The hepatic artery is rather larger than the splenic in young subjects; but smaller in the adult; yet the liver in the latter is at least five times larger than the spleen. The branches of the splenic artery are said to be very large in comparison with the trunk; and the coats of the artery are remarkably strong. Its resistance, compared to that of the aorta, near the emulgents, was as 1312 to 1000. The spleen has a large single vein, which constitutes one of the principal trunks of the vena portarum. In a child of three months, according to Haller, the artery measured $\frac{1}{3}$ of an inch, the vein $\frac{1}{2}$: in a child of eighteen months, the numbers were 13 and 19; at three years, 14 and 26. According to sir Everard Home, "the trunk of the splenic vein, compared with that of the artery, when both are filled with wax, is found to be in the proportion of five to one in its size. This was ascertained both by an accurate measurement of their diameters, and by weighing half an inch in length of each in a very nice balance: the disproportion between them is greater than between corresponding veins and arteries in other parts of the body." (*Phil. Trans.* 1807. pt. ii. p. 49.) It has no valves. Injected fluids of all kinds pass with the greatest facility from the artery into the vein. There are numerous superficial absorbents, belonging principally to the peritoneum: of deep-seated absorbents, there is little known. The absorbents are easily demonstrated in the calf. If air is impelled under the membrane of the spleen, numerous knotted lymphatic trunks appear, arising from the whole surface of the viscus, and passing with the great blood-vessels towards the receptaculum chyli. Many observers have noticed and described them in animals; but they are not so conspicuous in man. The nerves are small; they come from the celiac plexus, and form a slender splenic plexus, surrounding the artery, and entering the spleen with its branches. If the organ, in its natural state, possesses any sensibility at all, it is very inconsiderable. For further particulars on these points, see ARTERY, VEIN, NERVE, and ABSORBENT.

The substance of the healthy spleen readily yields to any force,

SPLEEN.

force, and is easily broken down. It appears, when divided, soft and spongy. Its colour is deeper than that of the surface. It seems thoroughly penetrated with blood, which is not coagulated, which may be squeezed out, but does not flow very readily. In some subjects, more particularly young ones, there is a granular appearance, arising from numerous small bodies, called acini: these are rendered more visible by breaking the spleen, and observing the broken surface. If the divided surface be scraped with a knife, blood is expressed, and some of the parenchymatous substance is usually detached. If we subject it to frequent washings, the blood is discharged from it, and the organ is reduced to a loose spongy tissue of whitish fibres and laminae; many of which adhere to the internal surface of the fibrous membrane. If the blood is carefully pressed out from the vessels, and they are then washed out by repeated injections of water, the spleen, carefully inflated and dried, exhibits a mere cellular and spongy mass.

This parenchyma of the spleen consists of the blood-vessels, ramified in the usual way, and terminating in a capillary system, and of certain cells, which are easily injected from the splenic vein with coarse injection. The ramifications of the veins, and these cells, are of very delicate structure, so that they easily give way under injection.

The cells of the spleen were noticed by Malpighi, who describes in the organ a number of small glands, hollow, and surrounded by arterial zones, into which he had never been able to trace any venous branches. Cuvier describes small corpuscles, whose use is unknown. Sir Everard Home says, in his observations on the structure and uses of the spleen, "I have examined it after death, under the ordinary circumstances, and have found the appearances described by Cuvier. I have also examined it frequently immediately after the stomach had received unusual quantities of liquids, and in that state have found invariably that the corpuscles of Cuvier, which were the glands of Malpighi, are distinct cells, containing a fluid, which escapes when the cells are punctured, and renders their membranous coat visible; so that it would appear that the distention of these cells is connected with the state of the stomach, and therefore only takes place occasionally; and that the elastic capsule, by which the spleen is surrounded, adapts the organ to these changes in its volume." Sir Everard states farther, that "in the spleen of the bullock, horse, and hog, the cells, when the arteries and veins are injected with coloured size, are seen to have numerous arterial branches ramifying in their coats, but no venal ones, which confirms the statement of Malpighi: and when the cells are empty and contracted, and the blood-vessels filled to a great degree of minuteness, the appearance of cells is entirely lost, as stated by Cuvier. When the cells were in a distended state, their cavities, in a great many instances, were very distinct, having been laid open in making a section of the spleen. The intermediate parts of the spleen are but sparingly supplied with arterial branches; and the smaller ones (arteries?) do not appear to have any particular distribution. When the veins only are injected, their branches appear more numerous, and larger than those of the arteries, making the whole substance of the spleen of a red colour. They appear to arise from the outside of the cells, going off at right angles to their circumference, like radii. Where the injection has not been very minute, they are seen to arise at not many points of the capsule; but where the injection has got into smaller branches, their number is so much increased, that they appear to form plexuses round the cells." *Phil. Transf.* 1808, p. 47—49.

In a second paper on the same subject, sir Everard informs us, "that the spleen is met with in two very different states,

one of which may be termed the distended, the other the contracted, and that in the one its size is double what it is in the other. In the distended state there is a distinct appearance of cells containing a limpid fluid, distinguishable by the naked eye: in the contracted, these only become distinct when seen through a magnifying-glass. The distended state takes place when the stomach has received unusual quantities of liquids before the animal's death; and the contracted state, when the animal has been kept several days without any drink, before the spleen is examined." *Ibid.* p. 140.

It is observed by Haller, that in the calf, and most other herbivorous quadrupeds, the structure of the spleen is more obvious, and easily exhibited, than in the human subject. "In these animals, very strong and evident fibres and laminae arise from the external covering of the spleen, penetrate into the interior of the organ, are attached to the coats of the blood vessels, and lastly, having decreased in size, end in all directions in the pulpy structure of the spleen. In this way they compose a cellular tissue much more loose than in man. If water be thrown into the vein, the organ then pressed, and these proceedings repeated, until the fluid comes out clear, the whole may be distended, by inflation of the vein, into an appearance very much like that of the lungs. From this texture, there is a very free passage into the vein, which seems to open by very short branches, as it were foramina, into the cellular tissues. The fibres are neither muscular nor vascular, but cellular; on account of their strength in the larger animals, some have called them ligamentous." *Elem. Physiolog. lib. xxi. sect. 1. § 15.*

Heretofore great disputes existed about the small bodies called acini, which are observed in the substance of the spleen. Malpighi, who first noticed them, deemed them small hollow glands. Ruysch insisted that they were merely the minute vessels assuming a peculiar arrangement; and that this structure could be demonstrated by successful injections. The latter opinion has been gradually adopted by the best anatomists; among whom we may enumerate Albinus, Haller, and Soemmerring. "Qui nonnunquam occurrunt, acini vel glomeruli, microscopii ope accuratissime explorati, nihil aliud sunt nisi vasorum fasciculi, vel teretes penicilli, aut cirri vasculosi." *De Corp. Hum. Fabric. t. vi. p. 157.*

The resemblance of the spleen to glands in its structure, has led to a very careful search after an excretory duct; but nothing of this kind has ever been detected; although such discoveries have heretofore been published. We know of no connection between the spleen and any other organ, except by means of blood-vessels or nerves.

In a paper, containing experiments on the passage of fluids from the stomach into the general circulation, &c. published in the *Phil. Transf.* 1812, p. 51, sir Everard Home advances the opinion, that a secretion takes place into the cells of the spleen, that the fluids thus secreted are conveyed by the absorbents into the thoracic duct; and, consequently, that those vessels are excretory ducts of the spleen. With deference to this ingenious and indefatigable inquirer, we may suggest, that the fact of the spleen performing any secretion is not yet proved; consequently, that we need not employ ourselves in discovering the means of conveying away such secretion.

The blood of the spleen seems to be distinguished by some peculiarities. It is never seen coagulated: Haller says that he never saw it in that state; but according to Soemmerring, a true clot (polypus) has been observed in the splenic vein. (*Elem. Physiolog. t. vi. p. 404. De Corp. Hum. Fab. t. vi. p. 156.*) It is said to be darker coloured than other venous blood; but exposure to oxygen gives it the scarlet tint.

Haller says also that it contains more water, the proportion of this element in it, compared to that in other blood, being as $\frac{3\frac{1}{2}}{4}$ to $\frac{3}{5}$. The thick part subsiding to the bottom of the vessel was less; as 3 to 6. Sir Everard Home confirms the fact of the greater quantity of serum in splenic blood. (Phil. Transf. 1808, p. 138.) Neither, according to the representation of Haller, are these the only distinguishing characters of splenic blood. It has been found, he says, to contain more volatile salt, and less empyreumatic oil. The experiments on which the above observations are grounded afforded similar results on repeated trials, and in various animals.

The spleen is very small in the fœtus, and appears remarkably so, if compared to the kidneys or liver. It rather increases towards the end of pregnancy. No remarkable changes occur in it after birth: in old persons it is often diminished; and its external coat is thicker.

A spleen, or at least a body so considered, and called by that name, exists in all the orders of the vertebral division of animals; but, if we may judge from the size, its importance seems to diminish successively from mammalia to birds, thence to reptiles, and from them to fishes. Mammalia resemble man in having the spleen placed close to the left end of the stomach; but they exhibit considerable varieties in the size, figure, colour, and texture of the organ. It is proportionally large in man, being twice as large as in the ox for example. In birds, reptiles, and fishes, the spleen is not only smaller, but firmer and more rounded; not so constantly placed near the stomach, but in the midst of the mesentery for example. The relations and sources of its blood-vessels are also different. Instead of a large peculiar branch, it has small branches from a stomachic artery, or from the mesenteric.

The use of the spleen still remains a problem, towards the elucidation of which the investigations of so many anatomists and physiologists have hitherto afforded very imperfect data. In beginning his observations on this subject, Haller very sensibly admonishes his reader that "he is plunging into the region of mere conjecture, darker than in the case of any other viscus." We might have hoped to derive some light from the diseases under which it frequently suffers, and from the experiments, in which it has been removed in animals. The inferences, however, to which we arrive in this way, are only of the negative kind; they enable us to destroy or refute, but not to build up or establish. The spleen may be found considerably altered in texture, where the individual has enjoyed good health before death, or has died of other complaints. It is often enormously enlarged, without materially affecting the health; and, on the other hand, where ill effects are produced, they have no peculiar character, affording illustration of the use of the organ.

The experiment of removing the spleen seems to have been performed in very ancient times. Pliny says, that animals will live after this part has been torn out (lib. xi. c. 30.); and the same fact is noticed in the Talmud (Ginzburger, Medic. Talmud. p. 11.) Haller cites various instances, in which the spleen has been lost in the human subject; particularly Leon Fioravanti, tesoro della vita umana, l. ii. c. 8. Phil. Transf. N° 451. The removal of it from the dog is an experiment repeated over and over again. (See Haller, t. vi. p. 421.) We find that animals, and even human subjects, have lived without a spleen, and enjoyed tolerable health. Sometimes the experiment has been fatal, but not from the loss or interruption of any function, that could be ascribed to the spleen. We find that dogs have been lively, fat, and even plethoric; that they have had good appetites; that bitches have produced

young. Some thought they were more falacious; others, that they made water more frequently. In some cases appearances were noticed, that might be referred to imperfection in the digestive process, as borborygmi. The liver is said to have suffered, in a few instances: in most, however, there seems to have been good bile made; and generally no particular ill effect was experienced.

The inference, then, to be collected from these sources is, that the function of the spleen is of so little importance, that the alteration of its texture by disease is not marked by any unequivocal symptom, and even that its entire removal is hardly followed by any sensible effect.

It has been a generally received, and long prevalent notion, that the office of the spleen is related to that of the liver; that the blood, either by its retarded motion through the serpentine splenic vessels, its stagnation in the splenic cells, or other changes wrought in it by the actions of the spleen, acquires peculiar properties, rendering it fit for the secretion of bile in the liver. It is supposed that the splenic blood is loaded with carbon, which the action of the liver separates from it. We do not usually meet with such arrangements as these in the animal economy: indeed no instance could be adduced of the like nature;—one organ to carbonize the blood, that it may be decarbonized by another; or a part to produce changes in the blood, fitting it for the secretion which is to be performed by another. The tissue of each gland has the power of extracting its peculiar secretion from the common mass. That the spleen produces changes in the properties of the blood is not yet clearly proved: still less is it proved that such changes, if produced, are in any way concerned with the biliary secretion. Further, bile is secreted where the spleen has been removed; and it was secreted, in the case recorded by Mr. Abernethy, where the vena portarum emptied its blood into the inferior vena cava. We observe no constant relation between the spleen and liver: the former is extremely small in many birds, reptiles, and fishes, where the liver is large.

The close neighbourhood of this organ to the stomach, and the connection of their blood-vessels, have led to the conjecture that they are connected in function. It has been imagined, that when the stomach is empty, the spleen, like a sponge, swells with blood, and affords a reservoir for the quantity of that fluid, which the blood-vessels of the stomach do not require in the inactive state of the organ; while, on the contrary, when this bag is distended with food, and the process of digestion demands a more copious afflux of fluids into the stomachic vessels, the pressure of its great extremity empties the splenic sponge, and thus causes a greater flow in the other parts of the cœliac system. This, again, is all imaginary: not a single point of it founded in observation. It is quite inapplicable to the three lower classes of vertebral animals, where the position of the spleen in many instances, and its firmness in several, are quite incompatible with the explanation.

In two papers, published in the Philosophical Transactions for 1808, on the structure and use of the spleen, Sir Everard Home attempted to prove, that fluids are conveyed from the cardiac end of the stomach into the spleen, and thus arrive in the general circulation, without the intervention of the general absorbing system and thoracic duct. Having tied the pylorus, he injected coloured fluids into the stomach: they were partly absorbed, and manifested their presence in the circulating system by changes produced in the urine. When rhubarb was used, the cut surface of the spleen produced a decided yellow tint on paper, and the serum of the splenic blood manifested the presence of rhubarb, on the addition of potash; when no such phenomena were

were exhibited by the cut surface of the liver, or in the serum of blood from the vena cava. There was a corresponding difference between the effects of potash on fluids, in which the substance of the liver and that of the spleen were broken up. The author abandons this notion in a subsequent communication to the same society, on the passage of fluids from the stomach into the general circulation; having found that corresponding phenomena were exhibited, after the spleen had been removed. Phil. Trans. 1812.

Of numerous other dreams about this mysterious organ, such as that it forms the red globules of the blood, that it is the seat of laughter, or of the sentient soul, that it is designed to balance the liver, &c. &c. we can say no more than that those who are interested in such speculations will find ample amusement in Haller's Elem. Physiol. lib. xxi. sect. 2; or in Soemmerring de Corp. Hum. Fabrica, t. vi. p. 158, et seq. One fact, mentioned by the latter author, may be stated, viz. that steel given for some time to animals has the effect of diminishing the size of the spleen.

SPLEEN, Diseases of the, in Medicine. Much more has been written by the older writers respecting the diseases of this organ, than by those of the last half century. This may have arisen partly from the greater accuracy of modern pathologists, but chiefly perhaps from the actual diminution of these maladies, in consequence of the diminution of the prevalence of intermittent fevers, of which many of the chronic derangements of the spleen were the *sequela*, or direct result. The *infarction* of the spleen, of which the older authors so often treat, was of this nature. The two principal modifications of disease, to which this viscus is subject, are inflammation, and their indolent enlargement of its substance, formerly called infarction. We shall treat of these diseases separately; and then enumerate some of the other morbid conditions, with which the spleen has been occasionally observed to be affected.

SPLEEN, Inflammation of, splenitis of the nosologists. This may occur, as in the other viscera, in two forms; either attacking the investing membranes, or the substance of the gland. Under both forms, however, it is a rare disease, but especially under the latter, the symptoms of which are apparently obscure, and not satisfactorily understood.

The peritonæal coat of the spleen is, in fact, seldom inflamed, according to the testimony of that excellent anatomist, Dr. Baillie, unless when the peritonæum in the neighbourhood is also affected. The proper capsule of the spleen, he remarks, is so intimately connected with the peritonæum, which is reflected over it, that it must necessarily partake of any inflammation affecting that membrane. Accordingly the symptoms, attending this inflammation of the coats of the spleen, are not to be distinguished from those which characterize inflammation of that portion of the peritonæum which lies in the left hypochondrium (see PERITONITIS); that is to say, there is pain in that region, more or less violent according to the degree of the inflammation, which is increased by pressure, and is accompanied by a sense of heat and tension in the part. There is also more or less of symptomatic fever, heat of skin, quickness and hardness of pulse, thirst, &c.; and, if the inflammation be considerable, some difficulty of breathing. The last symptom arises from the pressure of the diaphragm, when descending, in the act of inspiration, upon the inflamed parts. As the use of the spleen in health is unknown, we cannot, of course, look for any symptom characteristic of its disordered function, as in the case of other large viscera; but must infer that it is the seat of inflammation, from the situation of the pain, and from the absence of disturbance, in any considerable degree, in the functions of the neighbouring viscera;

as in that of the kidneys, exhibited in the urine; in that of the stomach, great intestine, &c.

It is probable, however, that the investing membrane of the spleen is liable to some degree of inflammation, which is not always noticed; for it has been remarked by the able pathologist just quoted, that it is not uncommon to find adhesions between the spleen and the neighbouring parts. Those adhesions consist of a white transparent membrane of more or less firmness, and generally connect the broad surface of the spleen more or less closely to the diaphragm. They often also connect the spleen to the great end of the stomach, and a part of the transverse arch of the colon. See Baillie's Morbid Anatomy of some of the most important Parts of the Human Body, chap. xi.; and Morgagni de Sedibus et Caus. Morborum.

The inflammation or suppuration of the substance of the spleen is a very rare occurrence; but such cases have been occasionally observed, and related by authors. (See Lieutaud, Histor. Anatom.-Medica, tom. i.) This writer has even related instances of mortification of the substance of the spleen; but neither Morgagni nor Baillie have observed such cases. The symptoms which have been described, as belonging to inflammation of the substance of the spleen, are, a dull pain, with a sense of fulness, in the left hypochondrium, the pain being increased on pressure, and accompanied by the general disturbance of the system, called fever. The disease, however, is so rare, that sufficient observations have scarcely been made to determine satisfactorily the diagnosis of this malady. In two cases, in which the inflammation of the spleen had advanced to suppuration, which were examined by Dr. Hunter, the patients were unable to define accurately the seat of their pain, which seemed to travel a good deal over the general cavity of the abdomen.

Although the diagnosis be imperfectly established, however, the same practice will be efficacious, which experience has found to be remedial in the inflammation of the peritonæal coat, or of the substance of other viscera, and of the peritonæum lining the abdomen; that is, the early use of blood-letting, and purgatives, with blisters and local bleeding, as circumstances may require; and the steady adoption of the antiphlogistic regimen, as directed in the treatment of other visceral inflammations. (See PERITONITIS, HEPATITIS, &c.) We shall, therefore, proceed to describe the second form of disease peculiar to the spleen.

SPLEEN, Tumid. This disease of the spleen consists of an indolent enlargement of the substance of the viscus, which, at the same time, becomes much harder than natural. It will occasionally be enlarged to five or six times its natural size, and it then forms a tumour very capable of being distinguished in the living body. When examined after death, the natural structure seems to be preserved, except that it is much more compact, the parts being much more closely applied together. When this tumour and induration are the consequence of intermitting fever, the mass is called an *ague-cake*. In general, this state of the spleen is considered as scirrhus; but its structure, as Dr. Baillie remarks, is not similar to scirrhus in other parts of the body. It may, therefore, be doubted whether this is a proper scirrhus affection of the spleen, or whether it is not, in fact, something essentially different.

The symptoms accompanying an enlarged and indurated state of the spleen, in its early stages, are not very manifest or urgent; in fact, the existence of the disease is commonly not suspected, till it has made a considerable progress. It is usually not accompanied by any pain or uneasiness; and will even bear a pretty strong pressure, with-

out any painful sensation. But when the tumid spleen has attained a considerable size, it may be distinctly felt by the hand, and distinguished by its situation and general shape. Its anterior edge may be traced under the margin of the ribs upon the left side, and it is sometimes ascertained by this examination to be notched. Under this state of the disease the patient can only lie upon the left side; but he usually complains of a sense of fulness and weight, rather than of pain, dragging downwards towards the left side, and of some oppression of the stomach after eating. The complexion is always of a dirty, fallow, or leaden hue. The patient is also said to be liable to hæmorrhages of the nose. If the enlargement goes on, it reduces the body to great emaciation, and at length terminates in an incurable dropsy. Dr. Pemberton mentions a tumid spleen, which he saw, which weighed three pounds two ounces. See Baillie, loc. cit. Pemberton on Various Diseases of the Abdom. Viscera, chap. v.

The last-mentioned author conjectures, that the spleen may be thus affected with a *swelling* of its substance, merely from a larger quantity of blood being conveyed to it by the arteries, without these arteries taking on that action which is essential to inflammation. It is evident, indeed, that this enlarged and compact state of the viscus is something entirely different from the ordinary results of inflammation, and is perhaps peculiar to the structure of the spleen alone. It will not unfrequently subside spontaneously, or with the assistance of medicines, to its natural size, and seems to be accelerated in that progress by the use of mercurial friction upon the abdomen, and by the administration of purgatives. The patient should persevere in the mercurial course, till the mouth is slightly affected, and then it should be gradually laid aside. Small doses of calomel, in union with the extract of conium, answer the double intention of allaying the irritation of the stomach, and of promoting absorption; and if there is a considerable degree of tenderness, which is sometimes produced by an enlarged spleen about the articulations of the false ribs with the spine, it may be removed either by leeches or cupping. The diet of the patient should consist of milk, gruel, and a small quantity of animal broth.

With respect to the prognosis, Dr. Pemberton observes, the most favourable symptoms are, a diminution of the uneasy sensations in the left side, and an improvement in the colour of the skin: the most unfavourable are, an increase of the swelling of the left side, and the lower part of the abdomen becoming enlarged: and if this part gives a sensation of fluctuation, the case is almost hopeless. Loc. cit.

SPLEEN, Morbid Changes of the. Among the other morbid conditions of the spleen, to which we have already alluded, may be mentioned, first, an extreme *softness* of the organ, which is not uncommon in middle and more advanced life. In these cases, the substance of the spleen seems to consist of little else than a very soft brownish-red mucus, intermixed with a spongy fibrous texture. This state of the spleen is not marked by any peculiar feelings, so as to make the persons conscious of any disease, and is probably of very little consequence in the general economy of the animal. The spleen, indeed, is said to be occasionally wanting, as a defect in the natural formation, and it has even been cut out, both from men and quadrupeds, without occasioning them to suffer any inconvenience afterwards. Another disease of the spleen is the occurrence of *tubercles* in its substance, very similar to the scrofulous tubercles of the lungs, which are placed at regular distances from each other, and do not run into masses, and seldom or never sup-

purate. *Hydatids*, of the same kind with those found in the liver, are occasionally formed in the spleen; but they are much more common in the former viscus. *Calcareous concretions* have also been seen occasionally in the spleen, but they are very rare. Sometimes the spleen has been ruptured, in consequence of external pressure upon that side of the body where it is situated. This accident can seldom take place, when the spleen is of the common size, because it is well defended by the ribs; but it may readily happen, when the spleen is very large, so that a part of it passes below the margin of the ribs into the cavity of the flank. The only other morbid condition of any importance, which affects the spleen, is an occasional conversion of its coats into a *cartilaginous* substance, which is almost exclusively observed in this viscus. The cartilage is generally found in its convex surface, and rather resembles the cartilages of the ears and nose, than that which is found at the extremities of bones. These varieties of disease are not to be distinguished during life by any peculiar symptoms.

SPLEEN, in Ichthyology. The spleen in fishes is usually situated near the stomach in the left side of the abdomen. Its figure is generally triangular, sometimes oblong. Its colour is always more dusky and obscure than that of the liver. See FISH.

SPLEEN of Birds, in Ornithology. See *Anatomy of BIRDS*.
SPLEEN-Wort, in Botany, &c. See *ASPLENIUM* and *MILT-waste*.

SPLEEN-Wort, Rough. See *LONCHITIS*.

SPLENECTOMIA, the name given to the surgical operation of cutting out the spleen.

SPLENETIC, *σπληνικός*, a person affected with oppilations and obstructions of the spleen.

In splenic people, the spleen is swelled beyond the natural bulk; or it is hardened so, as to shew a scirrous tumour in it.

Splenic people are distinguished by a livid, lead-coloured complexion; and their character is, to be very prone to laughter; which is an expedient nature is supposed to make use of, to evacuate the too redundant humour the spleen is charged withal; whence it is, that the ancients made the spleen the organ of laughter; and hence that popular saying, of a person laughing heartily, that he *vents his spleen*.

SPLENETIC Waters. See *WATER*.

SPLENIA, compresses resembling the spleen in shape.

SPLENIC VESSEL, a large artery and vein of the *spleen*; which see.

SPLENITIS. See *SPLEEN, Inflammation of*.

SPLENIUS, called also *massoides posterior*, in *Anatomy*, a flat, broad, oblong muscle, situated obliquely between the back part of the ear, and the posterior and lower part of the neck.

It is partly single, and partly made up of two portions, one superior, the other inferior. These two portions are closely united backward, making only one plane, but they are divided above.

The two splenii represent a great Roman V, and the splenius, and sterno-mastoideus of the same side, form a figure like a Roman A, or the legs of a pair of compasses, the points of which are in an horizontal plane.

The two splenii serve to support the head in an erect posture, whether in standing or sitting; to moderate the flexion of the head forward, and to bring it back again to its natural posture. They serve alternately to co-operate with either of the sterno-mastoidei for the rotation of the head. The complexi are assistants to the splenii, to keep the head straight in sitting or standing, to hinder it from

inclining forward, and to raise it when inclined. When they act together, they, as well as the splenii, may move the head backward, while the trunk is bent forward, or when we lie upon the belly; this latter motion is commonly called *extenſion*, the other *flexion*. See STERNO-CLEIDOMASTOIDEUS.

SPLENIUS Capitis, a name given by Albinus to a muſcle, called by Winſlow, and others, the *maſtoideus ſuperior*, or upper portion of the ſplenius. Riolanus, and others, call it the *triangularis ſplenii*.

SPLENIUS Colli, a name given by Albinus to the muſcle, called by Winſlow, and others, *maſtoideus poſterior*, or the lower portion of the ſplenius; and by Cowper, the *muſculus inferior ſplenii*.

SPLENOCELE, a ſwelling of the hernial kind, produced by the ſpleen. Although ſuch is the meaning of this word, we believe the diſeaſe expreſſed by it is more imaginary than real. Its poſſibility may well be doubted.

SPLENT, or **SPLINT**, among *Farriers*, a callous, inſenſible excreſcence or griftle, that ſometimes ſticks to a horſe's ſhank-bone, generally on the inſide below the knee. If there be one oppoſite to it on the outſide, it is called a *pegged* or *pinned* ſplint; becauſe it does as it were pierce the bone, and is extremely dangerous. Some call this a *double ſplint*, and others a *thorough ſplint*.

Some horſes are more ſubject to ſplints than others; but young horſes are moſt liable to theſe infirmities, which often wear off, and diſappear of themſelves. Team-horſes are very apt to have them. Few horſes put out ſplints after they are ſeven or eight years old, unleſs they meet with blows or accidents. A ſplint that ariſes in the middle of the ſhank-bone is no ways dangerous; but thoſe that ariſe on the back part of this bone, when they grow large and prefs againſt the back ſinew, always cauſe lameneſs or ſtiſſneſs by rubbing againſt it; the others, except they are ſituated near the joints, ſeldom occaſion lameneſs.

It may be noticed, in reſpect to the cure of ſplints, that the beſt way is not to meddle with them, unleſs they are ſo large as to diſfigure a horſe, or ſo ſituated as to endanger his going lame. Splints in their infancy, and on their firſt appearance, ſhould be well bathed with vinegar or old verjuice; which, by ſtrengthening the fibres, often puts a ſtop to their growth; for moſtly the membrane covering the bone, and not the bone itſelf, is here thickened; and in ſome conſtitutions, purging, and afterwards diuretic drinks, will be a great means to remove the humidity and moiſture about the limbs, which is what often gives riſe to ſuch excreſcences. Various are the remedies preſcribed for this diſorder: the uſual way is to rub the ſplint with a round ſtick, or the handle of a hammer, and then touch it with oil of origanum. Others lay on a pitch plaſter, with a little ſublimatè, or aſenic, to deſtroy the ſubſtance: ſome uſe oil of vitriol, ſome tincture of cantharides; all which methods have at times, it is ſaid, ſucceeded; only they are apt to leave a ſcar, with the loſs of hair. Thoſe applications that are of a more cauſtic nature, often do more hurt than good, eſpecially when the ſplint is grown very hard, as they produce a running for ſeveral months, which often leaves an ugly ſcar. Mild bliſters, often repeated, ſhould be firſt tried as the moſt eligible method, and will generally ſucceed, even beyond expectation; but if they fail, and the ſplint be near the knee or joints, fire and bliſter, in the ſame manner as for the bone ſpavin.

Splints on the back part of the ſhank-bone are difficult to cure, by reaſon of the back ſinews covering them; the beſt way is to bore the ſplint in ſeveral places with an

iron not very hot; and then to fire in the common way, not making the lines too deep, but very cloſe together.

SPLENTS, in *Surgery*, pieces of wood uſed in binding up broken limbs. See FRACTURE and SPLINTS.

The word is alſo ſometimes uſed for the pieces of a fractured bone.

SPLICE, *To*, in *Sea Language*, is to join the two ends of a rope together, or to unite the ends of a rope to any other part of it. There are ſeveral different methods of performing this operation, according to the ſervices on which it is to be employed. The *ſhort ſplice* is made by untwilling the ends of two ropes, or the two ends of one rope, and having placed each of the ſtrands of one oppoſite to, and in the interval between two ſtrands of the other, to draw them cloſe together; and then interweave the ſtrands of the one into the alternate ſtrands of the other, by penetrating the latter with a fid or marline ſpike, parallel to the axis or length of the rope. This ſplice is uſed on the cables, ſlings, block-frops, and in general all ropes which are not deſigned to run through blocks, or where the ſplice is not in danger of being looſened or ſeparated.

The *long ſplice*, being fixed in three places, occupies a greater extent of the rope; but by the diviſion of the joinings, the bulk is alſo divided into different parts of its length. Hence, it is much neater and ſmoother than the ſhort ſplice, and better adapted to run through the channel of a block, &c. for which uſe it is generally calculated.

The *eye-ſplice* being intended to make a fort of eye or circle at the end of a rope, the ſtrands are untwilled, and their extremities thruſt through the three ſtrands in that part of the ſaid rope on which the ſplice is to be formed, and thence paſſing over the ſurface of the ſecond ſtrand, they are again thruſt through the third, which completes the operation.

The *cut-ſplice* is conſtructed in the ſame manner as the eye-ſplice; being no other than the ends of two lines faſtened together, at a ſhort diſtance from each other, the extremities of either being interwoven into the bight of the other, ſo that the line becomes double in the extent of the ſplice. This is chiefly uſed in lead-lines, log-lines, and fiſhing-lines, where the ſhort ſplice would be liable to ſeparation, as being frequently looſened by the water. Falconer.

The *tapered ſplice*, moſtly uſed on cables, is made by unlaying a certain length of each cable, then placing them together, and interplacing the ſtrands, as in the ſhort ſplice, twice each way, and hauled tight each time; then inlay the ſtrands, or ends, ſucceſſively, and reduce them to a ſingle ſtrand, which is again thruſt through, and cut off. The ſplice is then ſerved over with ſpun-yarn, ſomething more than the whole length. *Drawing-ſplice*, uſed on cables, is made by unlaying about three fathoms of the ends; then place them together, and make a ſhort ſplice; then leave about one fathom, and from thence reduce each ſtrand to a long taper, by gradually cutting away as many yarns as neceſſary, and neatly point over the taper; then lay the ends up the cut-lines, and clap in a quarter-ſeizing at each end of the ſplice, an end-ſeizing at the beginning of the pointing, and a ſtop at the ends of the tails. This is the beſt ſplice for cables, as it may be readily taken aſunder. Another good method of making a *cable-ſplice* is to put the ends in twice each way; then to pick out the ſtrands, worm part of them round the cable, and taper away the reſt, which ſhould be marled cloſe down; then clap on a good throat and two end-ſeizings of ratline.

SPLICE, *To*, among *Gardeners*, is to graſt the top of one

tree into the stock of another, by cutting them sloping, and fastening them together.

SPLINTS, in *Ancient Armour*, a defence for the arms, which constituted part of the suit denominated an *Almaine ryvatt*.

SPLINTS, are long pieces of thin wood, or pasteboard, used in *Surgery*, for affording support and steadiness to fractured bones.

SPLINTERS of the *Bone*, in *Fractures*. In cases of fractures, the surgeon is frequently troubled with splinters of the bone in the way, which vellicate and prick the neighbouring parts, and render the proper execution of his office very difficult. If these splinters are loose, and have no connection with the bone, they must be carefully lifted out of the wound; if they hang to the bone in some part by the periosteum, that must be cut off with the scissors; but if they adhere pretty firmly to the neighbouring parts, and do not hinder the reduction of the bone, it is best to replace the bone, and leave them either to loosen, and come out of themselves by the suppuration of the parts, or to grow again, as they sometimes will safely and firmly do, to the rest of the bone. When they adhere pretty firmly to the principal parts of the bone, they should never be extracted by force, but replaced with the greatest exactness; for when this is properly performed, they will frequently unite to the rest of the bone.

When the points of splinters of bones stick so far out, that they are a great hindrance to the reduction of the bone, you are diligently to consider whether you can, by any means, contrive their reunion to the bone, which may be determined, by observing at what distance they are from the large bone, and what quantity of flesh there is intervening: when they cannot be reduced, or reunited to the bone, they must be removed with a pair of strong forceps, or, if they stick very firmly, with a fine saw. If the splinters are buried under the skin, and cannot be got at with hands, it is proper first to try if they can be reduced to their natural situation; and if they cannot, an incision must be made through the skin, that they may be taken out. See **FRACTURE**.

SPLIT, in *Botany*, a name given by some authors to the great *fumaria bulbosa*, or hollow root.

SPLIT, at *Sea*. When a sail is blown to pieces, the seamen say it is split.

SPLIT, when applied to a ship, denotes the state of being stranded and bilged on a rock or shore.

SPLIT *Rock*, in *Geography*, a rocky headland on the W. side of lake Champlain; 56 miles N. of Skenesborough.

SPLITTING, in *Agriculture*, a term employed in the practice of paring land with the plough in some districts. In it the plough always turns upon the left of the first furrow, and the coulter is held close all the way to the lifted slice previously turned over, and which now covers a balk or rib of whole unmoved ground. The same sort of work, in some of the eastern districts of this country, is denominated wrest-balking; but the practice has there a very different intention to that which induces it in the county of Devon and some others.

It is a term which is likewise used in common ploughing to signify the division of the ridges, by making the furrow parts of the old ones the middle parts of the new ones. Thus, by beginning at the furrows, and laying the furrow slices of the different ridges towards each other, by continually turning in that direction, the furrows become the middles and the middles the furrows. It is used in opposition to *gathering*, which has the contrary effect.

It is used too in setting and taking up some sorts of crops

which are set in particular manners, as those of the potatoe kind, when set in the ridge method, as by splitting the ridges with the plough or other tool, the sets are uncovered, and persons are enabled to pick and secure the potatoes, &c.

SPLITTING. To split a thin piece of metal, as an old silver groat, place the metal on the heads of three pins stuck up triangularly, and let a heap of flour of brimstone burn out upon it; then throwing it hard against the floor, the upper part will separate from the lower. Boyle's Works, abr. vol. i. p. 134.

SPLUGEN, in *Geography*, a mountain in the county of Chiavenna; 8 miles N.W. of Chiavenna. Towards the summit of the mountain is an oval plain, about two miles long and one broad, encircled with craggy points: it produces no trees, but yields rich pasture: near the summit are rude blocks of a whitish kind of marble. Above this oval plain is the source of the Lira, which falls into the lake of Chiavenna. On the other side of the highest ridge the torrents flow towards the Rhine. The passage over mount Splugen is principally used for the transport of merchandize to and from Coire; it is kept open even in winter, though not without great difficulty: in that season the merchandize is chiefly transported on sledges, of which forty or fifty pass in a day.—Also, a town of the Grisons, situated upon the rise of a hill, at the bottom of a rugged chain of Alps, and principal place of a jurisdiction, in the Rheinwald; 16 miles N.W. of Chiavenna. Two high roads meet at Splugen; one from Chiavenna, and the other leading over the Bernard into Bellinzone. From Splugen to Arder the road continues by the side of the Hynder Rhine, through a mountainous region, which presents at every step the most awful magnificence of scenery.

SPODDEN, a river of England, which runs into the Roch, at Rochdale, in Lancashire.

SPODIUM, in *Pharmacy*, a kind of absorbent calx, or ashes, esteemed drying, and by some held to have the same virtues with coral.

The spodium of the ancient Greeks was a greyish kind of recrement, found in form of ashes, on the hearths of furnaces in which brass was made; and called by them *σποδιον*, which literally signifies *ashes*.

Spodium is a metalline powder, nearly akin, both in origin and use, to tutia and pompholyx; only it is heavier than either.

The spodium of the Arabian physicians, as Avicenna and others, was made of the burnt roots of rushes and reeds. Some moderns also make a spodium of ivory burnt and calcined to a blackness. This is sometimes counterfeited by burning bullocks' or dogs' bones; but these are of no value.

The anti-spodium, which the ancients substituted for their spodium, was made of myrtle-leaves, galls, and some other ingredients calcined.

SPODUMENE, in *Mineralogy*, *Triphane*, *Haiü*, a mineral which bears some resemblance to adularia, but differs from it in the structure, which is foliated, with a threefold cleavage. It divides into prisms with rhomboidal bases, having alternate angles of eighty and one hundred degrees. It is translucent and frangible, but somewhat harder than glass. The colour of spodumene is a greenish-white or grey, and sometimes oil-green. The specific gravity is from 3.192 to 3.218. It occurs, both massive and disseminated, at Uton, in Sudermanland, Sweden, at which place it has only been found at present. Before the blowpipe it separates into small gold-coloured laminæ, which melt by a continuation of the heat into a greenish-white glass.

The constituent parts of this mineral are given by Vauquelin as under.

Silex	-	56	to	64
Alumine	-	24	to	24.4
Lime	-	5	to	3
Potash	-	-		5
Oxyd of iron	-	5	to	2

SPOHREN, in *Geography*, a town of Saxony, in the circle of Leipzig; 2 miles S. of Zorbig.

SPOIL-BANK, a term expressing any heap of spare earth or stuff which remains, or is laid by in the cutting of a canal.

SPOILS, SPOLIA, whatever is taken from an enemy in war. See BOOTY.

Towns and lands taken from the enemy are usually called "conquests;" and allmoveable things constitute the "booty." This booty naturally belongs to the sovereign making war, no less than the conquests; for he alone has such claims against the enemy as warrant him to seize on his goods, and appropriate them to himself. His soldiers, and even the auxiliaries, are only instruments in his hand for asserting his right. He maintains and forms them. Whatever they do is in his name, and for him. Thus there is no difficulty even with regard to the auxiliaries; if they are not associates in the war, it is not made for them, they have no more right to the booty than the conquests. But the sovereign may grant the troops what share of the booty he pleases. At present, most nations allow them whatever they can make on certain occasions, when the general allows of plundering what they find on enemies fallen in the field of battle, the pillage of a camp which has been forced, and sometimes that of a town taken by assault. The soldier in several services has also the property of what he can take from the enemy's troops when he is on a party, or in a detachment, excepting artillery, military stores, magazines, and convoys of provision or forage, which are applied to the wants and use of the army. This custom being once admitted in an army, it would be injustice to exclude auxiliaries from the right allowed to the national troops. The Roman soldier was obliged to bring in all the booty he had taken to the public stock. This the general caused to be sold, and after distributing a part among the soldiers, according to rank, the rest was assigned to the public treasury.

Instead of the pillage of the country and defenceless places, a custom has been substituted more humane, and more advantageous to the sovereign making war; *viz.* that of contributions. Whoever carries on a just war, has a right of making the enemy's country contribute to the support of the army, and towards defraying all the charges of the war. Thus he obtains a part of what is due to him, and the subjects of the enemy, on submitting to this imposition, are secured from pillage, and the country is preserved. But a general who would not sully his reputation, is to moderate his contributions, and proportion them to those on whom they are imposed. An excess in this point is not without the reproach of cruelty and inhumanity: if it shews less ferocity than ravage and destruction, it glares with avarice. If for weakening an unjust enemy, or for punishing him, it be lawful to carry off his goods, which is allowed to be the case, the reasons that justify the former act, may also be pleaded in vindication of destroying what cannot conveniently be carried off. Thus a country is ravaged, the provisions or forage destroyed, that the enemy may not find a subsistence there. When his ships cannot be taken or brought off, endeavours are used to sink them; all this tends to put

an end to the war. But these means are to be used only with moderation, and according to the exigency. To tear up vines, or cut down fruit-trees, is accounted illegal and savage, except inflicted to punish some crime committed by the enemy against the laws of war. This is to desolate a country for many years, and what no safety can require. Such a conduct is not dictated by prudence, but by hatred and fury.

However, on certain occasions, matters are carried still farther; a country is totally ravaged, towns and villages are sacked, set on fire, and the inhabitants put to the sword. Dreadful extremity, even when forced to it! Savage and monstrous excesses, when committed without necessity! However, they are authorized by two reasons. 1. The necessity of chastising an unjust and barbarous nation, for checking its brutality, and preserving one's self from its depredations. 2. A country is ravaged, and rendered uninhabitable, for making a barrier, in order to cover a frontier against an enemy, who cannot be stopped in any other way. A hard resource indeed! says Vattel; but may it not be used against an enemy, when with the same views and purposes a sovereign lays waste his own provinces? But for whatever cause a country be ravaged, we ought to spare those edifices which do honour to human society, and do not contribute to the enemy's power; such as temples, tombs, public buildings, and all works of a remarkable beauty. What advantage is obtained by destroying them? He who acts thus declares himself an enemy to mankind, wantonly depriving them of these monuments of art and models of taste. This is the light in which Belisarius represented it to Tottila, king of the Goths. We still detest those barbarians for destroying so many wonders of art, when they over-ran the Roman empire. Though the resentment of the great Gustavus against Maximilian, duke of Bavaria, was entirely just, he rejected with indignation the advice of those who were for demolishing the stately palace of Munich; and took particular care to preserve that admirable structure.

However, if for carrying on the operations of a war, or the works of a siege, there be a necessity for destroying buildings of this nature; there is doubtless a right of so doing. The sovereign of the country, or his general, makes no scruple when reduced to it by necessity and maxims of war. The governor of a town evidently threatened with a siege, sets fire to the suburbs, that they may not be of use to the besiegers for lodging themselves in them. Nobody offers to blame him who lays waste gardens, vineyards, or orchards, for pitching a camp or throwing up an intrenchment; if some fine edifice be destroyed thereby, it is an accident, an unhappy consequence of the war, and the general is not at all blameable; unless, without the least inconvenience, he might have made his dispositions elsewhere.

In bombarding towns, it is difficult to spare the fine edifices; at present it is only the ramparts and defences of a place which are usually battered. To destroy a place with bombs and red-hot balls, is an extremity never practised without great reasons. But it is warranted by the laws of war, when an army has no other resource for reducing a place on which may depend the success of the war, or when it greatly annoys us. It is also sometimes practised when there is no other expedient of facing an enemy to make war with humanity, or for punishing him for some other illegal outrage. But it is with reluctance that good princes make use of their rigorous rights, and never but in extremities.

Fortresses, ramparts, and every kind of fortification, relate solely to war, and as in a just war nothing is more natu-

ral than to raze those which we do not intend to keep, so nothing is more lawful. The enemy is thereby weakened, and no innocent person is involved in the damages.

Although to ravage or burn a country is not in general against the laws of war, yet if an enemy of a much superior strength treats a town or province in this manner, which he might easily keep for procuring to himself an equitable and advantageous peace, he is generally accused of making war like a barbarian. Thus the voluntary destruction of public monuments, of temples, tombs, statues, paintings, &c. is absolutely condemned, even by the voluntary law of nations, as always useless to the lawful end of war. The pillage and destruction of towns, the desolation of the country, ravages, burnings, are not less odious and detested on all occasions, when evidently practised without necessity, or without urgent reasons. But as all these enormities may be excused under pretence of punishment, which the enemy deserves, Vattel adds, that by the neutral and voluntary law of nations, only enormous offences against it are to be punished in this manner: and when rigour is not of an absolute necessity, it is always beautiful to listen to the voice of humanity and clemency. Cicero condemns the destruction of Coriath for its insults towards the Roman ambassadors; because Rome was able to assert the dignity of its ministers, without carrying its revenge to such extreme rigour. Vattel's Law of Nations, b. iii. ch. 9.

SPOKEN-CHAIN, in *Rural Economy*, signifies provincially a chain of great strength, and sufficiently long for fixing upon the spoke of the wheel of a waggon, when the team is set fast in a slough, to draw it out by, &c.

SPOKES, the bars of a wheel that pass from the nave to the felly.

SPOKE-SHAVE, in *Block-making*, a kind of plane to smooth and finish the shells, which is a piece of steel, four or more inches long, and one and a half broad; sharp at one edge as a knife, and a quarter of an inch thick at the back: at each end are left about two inches of narrow steel, bent up as pegs, by which it is regulated and secured in a piece of wood ten inches long, and narrowed at each end, for handles.

SPOLETO, in *Geography*, capital of Umbria, or the duchy of Spoleto, the see of a bishop, immediately under the pope. It became a Roman colony A. U. C. 512; and 22 years afterwards, withstood the forces of Hannibal, after the battle near the Thrasymene lake. It was the residence of some of the Gothic kings, and under the government of Longinus, exarch of Ravenna, was made the capital of Umbria, with the title of duchy. It was very ill-treated by Frederic Barbarossa, for siding with pope Alexander III.; but the inhabitants of Perugia ruined it entirely. It contains 22 churches, 21 convents, and 17 hermitages. Here are several ruins of Roman antiquities, the chief of which are a triumphal arch, an aqueduct, and an amphitheatre. The cathedral is built almost entirely of marble, and contains some good pictures; 90 miles S. of Florence. N. lat. 42° 45'. E. long. 12° 48'.

SPOLETO, *Duchy of*, a province of the Popedom, bounded on the north by the Perugian and the duchy of Urbino, on the east by the marquisate of Ancona, on the south by Abruzzo Ultra and the Sabina, and on the west by the Orvietan and Patrimonio, about 40 miles in length, and nearly as much in breadth. It was anciently called *Umbria*, and received the name of Spoleto in the time of the Lombards, being erected into a duchy under duke Faroald. On the extinction of the Longobardian monarchy, it fell to the dominion of the Franks, still retaining its former

constitution, and afterwards was annexed to the papal territories. In 1798 this duchy was over-run by the French.

SPOLIARIUM, among the ancient *Romans*, the third part of the bath, used for undressing and dressing in.

Spoliarium was likewise a part of the gladiatorial schools, where their clothes and ornaments were laid, and where the wounded and killed were carried.

SPOLIATION, in *Law*, is an injury done by one clerk or incumbent to another, in taking the fruits of his benefice without any right to them, but under a pretended title. It is remedied by a decree to account for the profits so taken. This injury, when the *jus patronatus*, or right of advowson, does not come in debate, is cognizable in the spiritual court; as if a patron first presents A. to a benefice, who is instituted and inducted to it; and then, upon pretence of a vacancy, the same patron presents B. to the same living; and he also obtains institution and induction. Now, if A. disputes the fact of the vacancy, then that clerk who is kept out of the profits of the living, whoever he be, may sue the other in the spiritual court for spoliation, in taking the profits of his benefice. And it shall there be tried, whether the living were, or were not vacant; upon which the validity of the second clerk's pretensions must depend. But if the right of patronage comes at all into dispute, as if one patron presented A., and another patron presented B., there the ecclesiastical court hath no cognizance, provided the tithes sued for amount to a fourth part of the value of the living, but may be prohibited at the instance of the patron, by the king's writ of *indicavit*. So also if a clerk, without any colour of title, ejects another from his parsonage, this injury must be redressed in the temporal courts: for it depends upon no question determinable by the spiritual law (as plurality of benefices or no plurality, vacancy or no vacancy), but is merely a civil injury. Blackst. Comm. b. iii.

SPOLTORA, in *Geography*, a town of Naples, in Abruzzo Ultra; 12 miles S.E. of Teramo.

SPONDAULA, *σπονδαυλη*, formed from *σπονδη*, *libation*, and *αυλος*, *flute*, in *Antiquity*, a player on the flute, or other wind-instrument of that kind; who, during the offering of sacrifice, performed some suitable air in the priest's ear, to prevent his hearing any thing that might distract him, or lessen his attention.

SPONDE, HENRY DE, in *Biography*, a French prelate and ecclesiastical historian, was born in 1568. His father was secretary to Joan, queen of Navarre, and, being a Calvinist, educated his son in the same persuasion. He displayed, at a very early age, a great facility in learning languages, one of which was the native tongue of Scotland, which he acquired in a journey to that kingdom in the suite of the French ambassador. Upon his return, he studied the civil and canon law, and was made master of requests to the king of Navarre. In 1595 he abjured Protestantism, and in the following year declared his new opinions in a work, "De Cœmeteriis Sacris." In the year 1600, he accompanied cardinal de Sourdis to Rome, and some years after he was ordained priest. He then began to labour on his great work, *viz.* the "Abridgment of the Annals of Cardinal Baronius," to which has been added a "Continuation," brought down to 1640. In 1626 he was nominated by Louis XIII. to the bishopric of Pamiers, which he accepted only through the command of pope Urban VIII. He published "Ordinances Synodales," which were intended to assist in the conversion of his former associates. He also founded an ecclesiastical congregation, some seminaries and religious houses, and distinguished himself by all the

the episcopal virtues. He died at Touloufe in 1643, at the age of 78. Besides the works mentioned above, he published "Sacred Annals of the Old Testament to the Time of Jesus Christ," which are, properly speaking, an abridgment of Tormiel's Annals. His elder brother was author of "Commentaries on Homer;" "An Account of the Motives which induced him to unite himself with the Catholic Church;" and "An Answer to Beza's Treatise on the Marks of the Church." He died in the year 1595.

SPONDEE, **SPONDÆUS**, in the *Greek and Latin Prosody*, a foot of verse, consisting of two long syllables; as *vertunt, divos, campos*.

The spondee is a grave measure: all Greek and Latin hexameters regularly end with a spondee.

There are also *spondaic verses*; that is, verses composed wholly of spondees, or, at least, that end with two spondees; as,

"Constitit, atque oculis Phrygia agmina circumspexit."

SPONDIAS, in *Botany*, a name borrowed from the ancient Greeks, whose *σπονδιας*, or *σποδιας*, was a kind of wild plum, very distinct, most assuredly, from the present Indian genus, though there may be some similarity in their fruits.—Linn. Gen. 229. Schreb. 308. Willd. Sp. Pl. v. 2. 750. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 3. 108. Juss. 372. Lamarck Illustr. t. 384. Gært. t. 103. (Moubin; Plum. Gen. 44. t. 22.)—Class and order, *Decandria Pentagynia*. Nat. Ord. uncertain, Linn. *Terebintaceæ*? Juss.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, somewhat bell-shaped, small, five-cleft, coloured, deciduous. *Cor.* Petals five, oblong, flat, spreading. *Stam.* Filaments ten, awl-shaped, erect, shorter than the corolla, the alternate ones longer; anthers oblong. *Pist.* Germen ovate; styles five, short, distant, erect; stigmas obtuse. *Peric.* Drupa large, oblong, marked with five scars from the fall of the styles. *Seed.* Nut ovate, woody, fibrous, with five imperfect angles, and five cells.

Obf. Jussieu remarks, that the stamens are inserted into a glandular disk; or, in Linnæan language, receptacle of the flower; probably a nectary.

Eff. Ch. Calyx five-toothed. Petals five. Drupa superior, with a nut of five cells.

1. *S. Mombin*. Spanish Plum. Linn. Syst. Nat. ed. 10. v. 2. 1036. Syst. Veg. ed. 14. 428. Willd. n. 1. (*S. purpurea*; Linn. Sp. Pl. 613. *S. Myrobalanus*; Jacq. Amer. 139. t. 88. S. n. 1; Browne Jam. 228. *Myrobalanus minor*, folio fraxini alato, fructu purpureo, officulo magno fibroso; Sloane Jam. v. 2. 126. t. 219. f. 3—5.) Common footstalk compressed. Clusters much shorter than the leaves.—Observed by Jacquin to be wild in the territory of Carthage, South America, from whence it has been brought into the West Indian islands, in some of which, particularly Hispaniola and Jamaica, it abounds, being known by the name of the Spanish Plum-tree. The tree is various in height, of no regularity of growth, sometimes as tall as thirty feet, with a thick bark, and white brittle wood. Leaves about the ends of the branches, alternate, stalked, deciduous, pinnate, four or five inches long, of about ten pair of elliptical thinning, partly serrated, leaflets, an inch long, with an odd one of the same size. Flowers small, red, in short clusters, appearing before the leaves. Fruit ovate, purple, above an inch long, acid, with a singular but agreeable aromatic flavour, for which it is much esteemed.

2. *S. Myrobalanus*. Yellow Hog Plum. Linn. Syst. Nat. ed. 10. v. 2. 1036. Willd. n. 2. Ait. n. 1. (*S.*

lutea; Linn. Sp. Pl. 613. *S. Mombin*; Jacq. Amer. 138. S. n. 2 and 3; Browne Jam. 229. *Myrobalanus folio fraxini alato, fructu luteo, officulo magno fibroso*; Sloane Jam. v. 2. 125. t. 219. f. 1, 2. *Prunus americana*; Merian Surin. t. 13.)—Common footstalk round. Leaflets pointed, four or five pair. Clusters compound, about as long as the leaves.—Native of South America; cultivated in the West Indies. Miller had it alive at Chelsea in 1739. This is described as a tree resembling a common Walnut-tree in size and appearance, while the ample clusters of pale yellowish flowers are much like Elder, except in having no smell. The leaves are twice the size of the foregoing, with pointed, less serrated, leaflets. Fruit yellow, two inches long, in large clusters, its pulp fragrant, sweet, and agreeable, but the great size and fibrous nature of the stones render it not commodiously eatable. Hogs are fattened with these plums in Jamaica. We cannot but observe that Linnæus has changed his own original names of these two species, much for the worse; and those he has given are the more unfortunate, as they are directly contrary to what Jacquin had previously adopted.

3. *S. Mangifera*. East Indian Spondias. Willd. n. 3. (*S. amara*; Lamarck Dict. v. 4. 261. *Mangifera pinnata*; Linn. Suppl. 156. Retz. Obs. fasc. 5. 4. *Ambalâm*; Rheede Hort. Malab. v. 1. 91. t. 50, not 51.)—Common footstalk round. Leaflets entire, pointed, about three pair. Clusters repeatedly compound.—Native of the East Indies, flowering in January and July, and bearing two crops of fruit. This is difficult to distinguish by a specific character from the last, though widely different in many respects. That they are one genus, there can be no doubt. The trunk is a foot in diameter. Leaves of three pair, besides an odd one, of elliptical, pointed, entire, smooth, pliant leaflets, each four or five inches long, with one rib, and many parallel transverse veins. Rheede says they are agreeably acid. Clusters hardly so long as the leaves, thrice compound; their principal branches alternate, widely divaricated, smooth, purplish; flower-stalks crowded, bracteated, very short, but much elongated and spreading when in fruit. Flowers small and pale, sometimes six-cleft. Fruit oval, of a yellowish-green, an inch and a half long, eatable and agreeably fragrant. The *Cat-Ambalâm*, Rheede p. 93, seems to be the wild state of the same tree.

4. *S. dulcis*. Otaheitè Apple. Forst. Prod. 34. Pl. Esc. 33. Willd. n. 4. Ait. n. 2. (*S. cytherea*; Sonnerat Ind. Or. v. 2. 222. t. 123. Lamarck Dict. v. 4. 260. Jacq. Hort. Schoenbr. v. 3. 12. t. 272.)—Common footstalk round. Leaflets serrated, about six pair. Clusters repeatedly compound, spreading.—Native of Otaheitè, from whence it has been transported to the Mauritius, where also the last-described species is cultivated, as appears by specimens from Commerçon marked *Evia Amra*; for he distinguished the two. The present is a large erect tree, with brittle wood. Its leaflets are serrated, twice as numerous, and not half the size of the last. Flowers small, whitish. Fruit oval, orange-coloured, twice as big as the last, aromatic and eatable, resembling an apple in flavour, and by some voyagers much commended. Forster compares its taste to a pine-apple, and praises its salubrity. Sonnerat says it is like a rennet apple, but not so good; at least in the Mauritius.—This fruit has ripened in the stoves at Schoenbrun.

SPONDIAS, in *Gardening*, contains plants of the exotic tree kind, of which the species cultivated is the purple hog-plum, or Spanish plum (*S. mombin*).

This plant is cultivated in its native state by many for the sake of the fruit, which is pretty pleasant. And there

is a variety of this sort of fruit called the leather-coat, from the appearance of its skin.

Method of Culture.—It is increased by sowing the stones of the fruit in pots filled with light mould, plunging them in the bark-bed of the stove ; and by planting, cuttings, or putting down layers, and managing them in the same way : the plants may be taken off and removed into separate pots when they have stricken good roots, being re-plunged in the bark-bed.

They require afterwards to be kept constantly in the stove, and to have the same management as other woody exotics of the same nature.

They afford variety in stove collections among other similar plants.

SPONDYLI, Σπονδυλοι, in *Antiquity*, pellets of brass used in giving sentence, before the *κυμαροι*, or *beans*, came into use.

SPONDYLOLITHOS, a name given by authors to a stone found in the country of Tyrol, and elsewhere, resembling the vertebræ of an animal. It is in reality no other than the vertebræ of some sea-fish petrified, as is common with us.

SPONDYLUS, σπονδυλος, a term anciently used for a vertebra of the spina dorsii.

SPONDYLUS, in *Natural History*, a genus of the class and order Vermes Testacea, of which the generic character is : Animal a tethys ; shell hard, solid, with unequal valves ; one of the valves is convex, the other rather flat ; hinge with two recurved teeth, separated by a small hollow. There are four

Species.

CÆDAROPUS. The shell of this species is slightly eared and spinous. It inhabits the Mediterranean, the Indian, and other seas, and is found in almost infinite varieties, as to size, thickness, and colours ; sometimes entirely purple, orange, white, or bloom-colour ; sometimes marked with various streaks, spots, dots, or bands.

REGIUS. Shell without ears, and spinous. There are four varieties. One inhabits India, and one is found near Malta, which is very rare. The shell is sub-globular ; within it is white ; without purplish, scarlet, flame-coloured, orange or white ; the spines are usually two inches long ; it is sometimes cylindrical, with a crenate margin.

PLICATUS. Shell without ears or spines, plaited. It is found in India, some parts of America, and in the Mediterranean. The shell is white, with yellowish, reddish, brownish, or violet lines and veins.

CITREUS. Shell oblong, plaited, spinous. The shell is imbricate, about two inches long, and nearly as broad ; it is of a citron-colour, or red, with an orange inner margin.

SPONGE. See SPONGIA and SPUNGE.

SPONGE-Tree, in *Botany*. See MIMOSA.

SPONGIA, the *Spunge*, in *Natural History*, a genus of the class and order Vermes Zoophytes. The generic character is as follows : Animal fixed, flexile, torpid, of various forms, composed either of reticulated fibres, or masses of small spines, interwoven together, and clothed with a gelatinous flesh, full of small mouths on its surface, by which it absorbs and rejects water. There are about fifty species, of which nine or ten belong to this country.

The sponges consist of a ramified mass of capillary tubes, that were formerly supposed to be the production of a species of worms, which are often found within these cavities ; an idea, however, which is now generally exploded. Others have imagined them to be only vegetable productions : that they are, however, possessed of animality, appears evi-

dent, from the circumstance of their pores alternately contracting and dilating, and from their even shrinking, in some degree, from the touch, when examined in their native situations. Their structure enables them, it is thought, to absorb nourishment from the surrounding fluid. Sponges are the most torpid of all the zoophytes. The individuals differ very much from each other in form and structure. Some of them, as the *S. officinalis*, or common sponge, are of no determinate figure, but others are cup-shaped, tubular, &c. ; irregularly formed, porous, rough, lobed, and woolly.

Species.

VENTILABRUM. Fan-shaped, regular, soft, with reticulate woody veins, covered with pores like those of a honey-comb. It is found in the Norwegian and American seas ; about six inches high, and five broad : it exactly resembles a small gorgonia flabellum in its shape and ramifications, except that the pores are angular, and the substance is spongy.

FLABELLIFORMIS. Fan-shaped, orbicular, cartilaginous, with square articulate fibres. This species inhabits the Indian and Red seas. It is from six to eight inches in height, and four or five broad, and resembles the ventilabrum.

INFUNDIBULIFORMIS. This is funnel-formed, flexile, with the surface more or less roughened. It inhabits the Mediterranean and Indian seas, adhering to rocks, and is from six to eighteen inches in diameter ; in colour it is a pale brown, and less tenacious than common sponge.

FISTULARIS. Tubular, simple, brittle, and growing gradually larger. It inhabits the Indian ocean, is from three to four feet long : when dry it is blackish fulvous.

ACULEATA. Tubular, branched, tough, the tubes erect, proceeding from one side of the stem, and tapering. It inhabits the Indian ocean ; is from four to six inches high, of a deep orange-yellow colour, and hollow through the whole inside.

* **CORONATA**. Minute, consisting of a single tube, and crowned at the tip with a ray of spines. This is found in our own country, on the Sussex coast : its colour is of a pale yellow ; the rays that compose the crown are of a bright pearl yellow, hollow, and open at the top ; and when seen through a magnifier, it appears covered with little rising points.

CILIATA. Simple, tubular, conic, flexuous, tapering upwards, and fringed at the tip. It inhabits the Greenland seas, adhering to the larger ulvæ ; is about eight inches long ; white, silky, downy on the outside, and rarely found double.

CANCELLATA. Tubular, porous, with cancellate fibres. It inhabits the ocean ; is ferruginous, elastic, with a prickly surface ; the tube as thick as the finger, with a few elastic perforations.

RUBRA. Tough, simple, carious, dull red, roundish, depressed with elevated tubercles and equal pores. Inhabits the Red sea, fixed to stones.

NIGRA. Tough, globular, equal, inflated, black without, cinereous within. It is found on rocks in the Red sea.

OFFICINALIS. This species is irregularly formed, porous, tough, lobed, woolly. It is elastic, and very full of holes ; it grows into irregular lobes of a woolly consistence, and generally adheres, by a very broad base, to the rocks. It is chiefly found about the islands in the Mediterranean, where it forms a considerable article of commerce. A variety of small marine animals pierce and gnaw into its irregular winding cavities. These appear on the outside, by large holes raised higher than the rest. When it is cut perpendicularly,

SPONGIA.

ularly, the interior parts are seen to consist of small tubes, which are divided into branches as they appear on the surface. These tubes, which are composed of reticulated fibres, extend themselves every way, by this means increasing the surface of the sponge, and ending at the outside in an infinite number of small circular holes, which are the proper mouths of the animal. Each of these holes is surrounded by a few erect pointed fibres, that appear as if woven in the form of little spines. The tubes, with their ramifications, in the living state of the sponge, are clothed with a gelatinous substance, properly called the flesh of the animal. When the sponge is first taken, it has a strong fishy smell, and the fishermen take great care in making it perfectly clean, in order to prevent its growing putrid. See SPUNGE.

* **OCULATA.** Porous, soft, and very much branched, the branches a little compressed, erect, and often uniting together. This, as the asterisk indicates, inhabits the British seas. It is from five to ten inches high, of a pale yellow colour; the branches end obtusely.

MURICATA. Porous, much branched, angular, tough, the pores are cylindrical, fubulate, prominent, equal, many-cleft, and hispid. It inhabits Guinea, on rocks; it is grey, corky; the branches are surrounded on all sides with small, obtuse, shaggy tufts; the stem is as thick as a man's finger; the branches are about the thickness of a quill.

NODOSA. Porous, slightly branched, irregularly formed, rough and very tough, with knotty perforations on the branches. It is found on rocks in the American ocean; it is of a reddish-grey, or whitish, and about the size of the finger.

* **TOMENTOSA.** Porous, irregularly formed, brittle, soft, downy, interwoven with the minutest spines. This species inhabits the British, African, and Indian coasts, adhering to marine substances; when fresh it is of a bright orange colour, and full of gelatinous flesh; when dry, it is whitish, and very light; and if broken, it resembles the crumb, or soft part of bread. It appears to be composed of a number of minute spines, and upon handling, it stings and raises blisters like cow-itch.

BACILLARIS. Irregularly formed, caulescent, erect, with porous branches. It is found in the Norwegian seas; is about eighteen inches high, and of the thickness of the finger. It is round, of the consistence of common sponge, but somewhat more compact, with very numerous pores, appearing as if perforated with a fine needle.

* **DICHOTOMA.** This species is dichotomous, with erect, cylindrical, elastic, woolly branches, proceeding from one side of the stem. It inhabits European and Indian seas: it is from five to six inches high; in colour it is of a pale yellow, and full of minute pores.

* **STUPOSA.** This species has round, soft, downy branches. It is found on the Sussex coast; is three inches high, and of a pale yellow.

* **CRISTATA.** Flat, erect, soft, with rows of small pores, a little projecting along the top. This is found on the British shores, adhering to rocks; generally about two inches high and three long; it is of a yellowish colour, and growing in the shape of a cock's-comb.

* **PALMATA.** This species is, as its name imports, palmate, with finger-like divisions round the surface; the pores are a little prominent, and irregularly disposed. It inhabits the Sussex coast; it is of a reddish colour, inclining to yellow, with a soft woolly substance, like *S. oculata*.

PROLIFERA. Flat, with numerous palmate branches, ending in finger-like divisions. It is found in the North American seas; grows in large bunches, is about six inches

high, very porous, reticulate within, and full of minute spines on the outside.

* **BOTRYCIDES.** This is a very tender species, is branched, and covered with bunches of ovate tubercles, open at the top. It inhabits the British coasts; is of a bright shining white colour; the bunches are made up of oblong, oval tubercles, like grapes, open at the end. The surface, when seen through magnifiers of considerable power, seems covered with masses of three-rayed spinous stars.

* **PANICEA.** Irregularly formed, whitish, soft, very tender, and full of minute pores. It inhabits the seas between this country and Holland, intermixed with fuci, and other marine productions; and is thought, from the similarity which it bears to the *S. tomentosa*, to be a variety of that species.

FULVA. This species is irregularly formed, but slightly branched, fulvous, and it is very rigid. It inhabits the American ocean; is gelatinous, and brown between the fibres.

TABULARIA. Compressed, sessile, a little rigid and yellowish, with small longitudinal tubes. This also is an American species, generally seated on rocks, frequently blackish within.

FIBRILLOSA. This species is irregularly shaped, a little flattened and tender, with divergent, crowded, interwoven fibres, and scattered toothed pores. It inhabits the Indian ocean, is grey, soft, fan-shaped, or divided, or caulescent.

FASCICULATA. This is rigid, sub-globular, composed of fibrous, prismatic, branched, fastigate bunches. This is found in the Mediterranean sea; is pale, fulvous, or yellowish-grey.

BASTA. A little rigid, blackish, in undulate divisions, with a round stem. It is an inhabitant of the Indian ocean, and found adhering to stones. It is as thick as the finger.

LICHENOIDES. This is irregularly shaped, with soft, branching, scattered, and somewhat connected fibres. It inhabits the Indian ocean, and resembles a shrubby lichen.

PAPILLARIS. Cruetaceous, tender, soft, with perforated papillæ. It inhabits the American ocean, as does the next; it is of a pale grey, and gelatinous.

CAVERNOSA. Irregularly formed, sessile, very tough, cavernous, hence its name, with numerous, prominent papillæ on the surface. It is about the size of a man's hand: yellowish-white, sometimes fulvous within.

SINUOSA. Cruetaceous, tender, tough, with a thickly porous surface. This is found in the Indian ocean, incrusting other bodies; it is of a yellowish-grey colour.

FRONDOSA. Grey, leafy, jagged, tough, sub-reticulate, and separated into divisions on one side. This is an Indian species.

AGARICINA. Compressed, lobed, sessile, downy, reticulate and muricate with stiff hairs on the outside. It is found in the Indian ocean, and is of a yellowish-brown.

TUPNA. Branched, soft, with ascending branches, every where muricate with stiff hairs. It inhabits the Mediterranean, and is of a woolly kind of substance.

MEMBRANOSA. Irregularly formed, slightly branched, cellular, muricate outwardly, purplish-black. This is found in the Indian ocean.

COMPRESSA. Simple, compressed, conic, with a longitudinal cleft or aperture internally. It inhabits the Greenland seas, is an inch long; erect and tawny.

PORCILLUM. Cylindrical, pedicellate, with a perforated top. It inhabits the North seas; is not more than a quarter of an inch long; whitish, and said to resemble a glass tumbler.

COALITA. This is very much branched, soft, tender, yellow; the branches are a little compressed. It inhabits the North seas; as do the three following.

PLANA. Expanded, crustaceous, fan-shaped.

CRUCIATA. White, compressed, with pinnatifid, obtuse, muriate, woolly branches.

OSSFIFORMIS. White, slightly branched, with a thickened pitted top.

MACIDA. White, crustaceous, projecting into spines.

FIGIFORMIS. This is porous, rigid, turbinate, with a perforated tip. It inhabits the Barbary coast.

* **LACUSTRIS.** Creeping, brittle, with erect, round, obtuse branches. It is found at the bottom of lakes in England and Sweden, covered with scattered pores, in which are sometimes found, during autumn, small blueish shining globules.

* **PULVIATILIS.** Green, erect, fragile, of many irregular branches. It inhabits the fresh waters of this country, Prussia, and other parts of Europe. It is of a dull green, with hardly the appearance of animal life, of a fishy smell, and with the pores full of green, gelatinous granulations; it very much resembles the last.

FRIABILIS. Cinereous, friable, sessile, irregularly shaped, and slightly branched. Found in the lakes of Germany, and is the food of fish.

CANADIUM. This is known by its dichotomous, round, incurved branches. It is found in old aqueducts, and has been thought not to belong to this genus.

SPONGIOLI, a word used by some authors to express the small button mushrooms, which are gathered before they expand or open their heads.

SPONGIOSUM, in *Anatomy*, spongy; a name given to a small separate bone of the nose, and to a process of the ethmoid bone. In the older writers, the ethmoid bone altogether has been called os spongiosum, from its complicated apparatus of bony plates, and numerous perforations. See **CRANIUM.**

SPONGY CHEESE, in *Rural Economy*, such as is soft and full of eyes, from neglect and want of attention in making. The remedies are, careful breaking, powerful squeezing, good skewing, and heavy pressing. See **CHEESE** and **DAIRYING.**

SPONHEIM, in *Geography*, a town of France, in the department of the Rhine and Moselle, late capital of a county, to which it gives name; 27 miles W. of Mentz. N. lat. 49° 54'. E. long. 7° 40'.

SPONHEIM, or *Spanheim*, late a county of Germany, in the circle of the Upper Rhine, situated between the Rhine and the Moselle, formerly governed by particular counts, at present divided between the elector palatine, the duke of Deux Ponts, and the margrave of Baden. The matricular assessment of the whole for a Roman month was 290 florins, and the tax to the imperial chamber 108 rix-dollars 20 kruetzers. The soil is in general mountainous, but fertile. Game and fish are plentiful, and the mutton esteemed excellent. The hills towards the Moselle and Nahe are covered with vineyards. Here are mines of copper, lead, iron, &c. and some medicinal springs. The principal towns were Cruetznach, Sponheim, and Traarbach; all now annexed to France.

SPONSIO, in *Political Economy*, denotes an agreement relating to affairs of state, made by a public person, who goes beyond the terms of his commission, and acts without the orders or commands of the sovereign. He who treats in this manner for the state, without having a commission, promises by this means to take such measures, that the state, or the sovereign, shall approve and ratify the agree-

ment; otherwise his agreement would be vain and illusive. The foundation of this agreement can be no other, on either side, than the hope of the ratification. The Roman history furnishes examples of this kind of agreements.

SPONSIO Judicialis, in *Law.* See *Feigned Issue.*

SPONSORS. See **GOD-FATHERS.**

SPONSUS, one of the many names given by the chemists to mercury.

SPONTANEOUS, SPONTANEUS, formed from the Latin adverb *sponte, of one's own accord*, in the *Schools*, a term applied to such motions of the body and mind as we perform ourselves without any constraint.

Thus, in morality, those actions performed upon an inward and natural principle, conformable to our own inclinations, excluding all constraint, are called spontaneous actions.

In medicine, an evacuation, effected without any application for that purpose, is called a spontaneous evacuation. And a lassitude or weariness, not occasioned by any preceding fatigue, is called a spontaneous weariness.

SPONTANEOUS Generation. See **EQUIVOCAL Generation.**

SPONTANEOUS Precipitation. See **PRECIPITATION.**

SPONTOON, in *Military Language*, is a weapon resembling a halberd, now used instead of a half-pike by the officers of foot. When the spontoon is planted, the regiment halts; when pointed forwards, the regiment marches; and when pointed backwards, it retreats.

SPOON-BILL, PLATEA, in *Ornithology*, the name of a bird of the long-necked kind, approaching to the nature of the stork and heron, and called the spoon-bill from the remarkable figure of its beak, which is different from that of all other birds, being broadest at the extremity, and terminating in a large, rounded, flat process, resembling a shovel; or, if it were hollow, a spoon. The whole bill of this bird is of a fine shining black, except a bright orange-coloured spot just above the point of the upper mandible, which is a little bent downward at its extremity; at the angles of the bill, on each cheek, there is also a spot of the same colour; the upper surface of the bill is elegantly waved with dotted protuberances; a depressed line, extending from the nostrils, is continued round it near its edge; its substance appears like whale-bone, being thin, light, and elastic; the tongue is short, and heart-shaped, and when drawn back, serves as a valve to close the entrance of the throat; when pulled forward, it has the appearance of a triangular button; the ears are large, and placed an inch behind the angles of the mouth; the plumage of the whole body, wings, and tail, is white; on the back part of the head is a beautiful crest of white feathers, hanging behind the neck; the legs are black, and also the thighs, which are naked about half their length; and the toes are connected by a small web, extending to the first joint on each.

This bird breeds on high trees, feeds on fish and water-plants, and can swim; it inhabits the continent of Europe, South America, and the Philippine islands.

A flock of these birds migrated into the marshes near Yarmouth in Norfolk, in April 1774. Pennant. See **PLATALEA.**

SPOON-DRIFT, in *Sea Language*, a sort of showery sprinkling of the sea-water, swept from the surface of the waves in a tempest, and flying according to the wind, like a vapour.

SPOONING, or **SPOOMING,** was formerly used to denote that movement in sailing, which is now called *scudding*.

SPOON-WORT, in *Botany.* See **COCHLEARIA.**

SPORADES, in *Astronomy*, a name which the ancients gave to such stars as were not included in any constellation.

These

These the moderns more usually call *informes*, or *extra-constellary stars*.

Many of the sporades of the ancients have been since formed into new constellations; *e. gr.* of those between Leo and Urfa major, Hevelius has formed a constellation, called *Leo minor*; of those between Urfa minor and Auriga, the same person has formed another constellation, called *Lynx*; and of those under the tail of Urfa minor another, called *Canis venaticus*, &c.

SPORADIC, *σποραδικος*, formed from *σπορας*, *dispersed*, of *σπειρω*, *I strew*, &c. in *Medicine*, an epithet given to such diseases as have some special or particular cause, and are dispersed here and there, affecting only particular constitutions, ages, &c.

Sporadic stands in opposition to epidemic diseases, which are those arising from a general cause, and that are common to all kinds of persons, of what complexion and quality soever.

SPORÆ, in *Botany*, from the Greek *σπορα*, *seed*, a name given by some botanists to the seeds of certain cryptogamic plants; by which they seem to imply a doubt of their being truly *semina*, or exactly analogous to the seeds of plants in general. We know not on what such doubts are founded. If the parts in question be produced or perfected by sexual impregnation, they are to all intents and purposes real seeds, nor does any peculiarity, or apparent simplicity in their structure, invalidate the propriety of their being so called. Seeds of different orders of phænogamous plants differ, as is well known, in their conformation, and even in the number of internal parts, as well as external coats, of which they are composed. Those of the more obscure cryptogamous tribes may therefore be expected to differ from them more widely. If such apparent seeds be not the offspring of sexual impregnation, they are GEMMÆ, see that article; where, as well as in our biographical account of the great HEDWIG, we have lamented that this distinguished philosopher and botanist should have been seduced, by less accurate observers, to adopt a term entirely subversive of his own doctrines and discoveries.

SPORANGIUM, from *σπορα*, *seed*, and *αγγος*, *a vessel*, a name used by Hedwig for the capsule of mosses, to which we have the same objection as to the term SPORÆ for their seeds. See that article, and HEDWIG.

SPORLING'S ISLAND, in *Geography*, a small island near the coast of New Zealand, a little to the N.E. of Gable End Foreland.

SPORLIVOI, Nos, a cape of Russia, on the S. coast of Nova Zembla. N. lat. 70° 30'. E. long. 60° 34'.

SPOROBOLUS, in *Botany*, from *σπορα*, *seed*, and *βωλλω*, *to throw*, because, as we presume, of the round deciduous seed.—Brown Prodr. Nov. Holl. v. 1. 169.—Class and order, *Triandria Digynia*. Nat. Ord. *Gramina*.

This genus of grasses is separated by Mr. Brown from *Agrostis*, by the following characters.

Calyx of two unequal unarmed valves, containing a single flower; the outer valve smallest. Corolla of two rather acute valves, without awns, sessile, longer than the calyx. Nectary of two scales. Stigmas villous. Seed obovate, tumid, naked, deciduous.

The species are found between the tropics, scarcely beyond the latitude of 35°. Some have only two *stamens*. The *flowers* are panicled. Sheaths of the *leaves* bearded, with hardly any membranous *glipula*. They are akin to *Agrostis*, especially to *A. virginica*. *A. diandra* of Linnæus is a *Sporobolus*, as well as *A. indica*. Besides the latter, two new species have been observed by Mr. Brown in New Holland, *S. elongatus* and *pulebellus*.

SPOROW, in *Geography*, a town of Lithuania, in the palatinate of Brzesc, seated on a lake to which it gives name; 28 miles W. of Pinsk.

SPORTS, in the *Customs* of Flanders, were in great vogue through Flanders and the Low Countries some centuries ago. Every city had a solemnity of this kind peculiar to itself: thus Bruges had that called the *Forester*; Valenciennes, the *Prince of Pleasantry*, and the *Prince of the Horse-Comb*; Cambray, the *King of Ribaldry*; and Bouchain, the *Provost of Sots*. Lille, one of the richest towns in Flanders, was not behind hand with its neighbours in celebrating sports, by the magnificence and diversions of which to draw together a vast concourse of people from all parts. One of the chief of these diversions was called the *King of the Spinet*, *Roy d'Épinette*, which was celebrated with great pomp and show. See Hist. Acad. Inscript. tom. iv. p. 452, seq.

SPORTULA, or SPORTELLA, in *Antiquity*, a dole, or largess, either of meat or money, given by princes, or great men, to the people or poor.

The sportula was properly the panner or basket in which the meat was brought, or with which the poor went to beg it; thence the word was transferred to the meat itself, and thence to money sometimes given in lieu of it. The basket was supposed to contain a quantity of hot provisions, of the value of 100 quadrantes, or 12½ pence; and these baskets were ranged in order in the hall, and distributed ostentatiously to the hungry or fervile crowd, which waited at the door. This indelicate custom is very frequently mentioned in the epigrams of Martial, and the satires of Juvenal. (See likewise Suetonius, in Claud. c. 21, in Neron. c. 16, in Domitian. c. 4. 7.) These baskets of provisions were afterwards converted into large pieces of gold and silver coin, or plate, which were mutually given and accepted, even by persons of the highest rank (see Symmach. epist. iv. 55. ix. 124. and Miscell. p. 256.) on solemn occasions, of consulships, marriages, &c.

Sportula was also frequently used in opposition to *recta cana*, a formal or plentiful meal; as in Martial.—“*Promissa est nobis sportula, recta data.*”

St. Cyprian gives the denomination *sportulantes fratres*, to such clergymen as then received gifts, or gratuities, for their maintenance.

SPOT, in *Ornithology*, the name of a particular species of pigeon, called by Moore the *columba maculata*. It is of the size of a small common pigeon, and was brought over to England from Holland. This species has always a spot upon its head, just above its beak, from whence it has its name. The feathers of the tail are always of the same colour with this spot, and the rest of the body is all white. The spot and tail are black in some, red in others, and yellow in others. They look very beautiful when they spread their tails and fly, and are a distinct species, as they always produce young ones of their own marks.

SPOTICO, in *Geography*, an island in the Grecian Archipelago, of an irregular form, about four miles long, and from one to two broad; 6 miles W.S.W. of Paros. N. lat. 36° 59'. E. long. 25° 12'.

SPOTS, in *Astronomy*, dark places observed on the disks, or faces, of the sun, moon, and planets.

The spots in the sun are only visible through a telescope: some distinguish them into maculæ, or dark spots; and faculæ, or bright spots; but there seems but little foundation for any such division.

The solar spots have not been long observed. They were first discovered by Galileo, in the year 1610, soon after he had finished his telescope.

In opposition to the received opinion of the unalterable

state of the heavens, he maintained, that these spots consisted of a kind of matter that admitted of very great and sudden alterations; that they adhered to the sun, which carried them round an axis of his globe in about a month; which axis he first supposed to be perpendicular to the plane of the earth's annual orbit, because the course of the spots appeared on the sun's disk as straight lines parallel to that plane; which then happened through a particular direction of the floating motions of the spots upon the sun's surface, as he soon inferred from the visible alterations in their shapes and situations to one another, when several of them appeared together: and thence he concluded, that the general course of the spots was frequently varied a little, in like manner as, to a person viewing the earth from a great distance, the clouds would appear to move parallel to one another, and to the equator, with the uniform velocity of the earth's diurnal revolution, unless disturbed a little from that regular course by their floating in the atmosphere. At first he took the apparent motion of the sun's to be, as we have stated, rectilinear and parallel to the ecliptic; but in consequence of a subsequent observation of the entire transit of a large spot, and of marking its place at noon, day after day, upon a circular paper answering to the sun's disk, he found its course was a little incurvated; and thence he concluded, that the sun's axis was a little inclined to the plane of the ecliptic.

Since Galileo's time, the subject of the sun's spots has engaged the attention of several astronomical observers. The position of the sun's axis, and the periodical time of his motion round it, have been more exactly determined, the knowledge of which depended upon the observation of these spots. In the year 1639, Scheiner published his "*Rosa Urфина*," containing near 2000 observations of solar spots for 20 years; in which time he frequently saw above 50 at once: but for 20 years after, betwixt 1650 and 1670, scarcely any appeared. He found that many of his spots scarcely exceeded 25 days in making an apparent revolution from a given place on the disk to the same again, that others took up 27 days, and some others near 28. Scheiner and Cassini the son have also observed, that the periodical times of the nearer spots to the equator are shorter than those of the remoter; and Cassini the father observed the like property in Jupiter's spots. These irregularities create great difficulties in determining the time of the sun's exact revolution about his axis. Cassini the father, however, by comparing many distant observations together, found a common measure of many such intervals of time to be $27^d 12^h 20^m$ very nearly. Hence it has been concluded, that the periodical time of the sun's revolution to a fixed star is $25^d 15^h 16^m$.

All spots consist of a black part in the middle, of some irregular figure, encompassed with a nebulous border of a colour less dark; and it often happens, after a gradual decay and disappearing of the black part, that its place seems brighter than the rest of the sun, and continues so for two or three days. These brighter spots are called *facule*; which see.

The sun's spots are very changeable as to number, form, &c. and are sometimes in a multitude, and sometimes none at all.

Some imagine they may become so numerous, as to hide the whole face of the sun, at least the greatest part of it; and to this ascribe what Plutarch tells us, *viz.* that in the first year of the reign of Augustus, the sun's light was so faint and obscure, that one might look steadily at it with the naked eye.

To which Kepler adds, that in 1547 the sun appeared

reddish, as when viewed through a thick mist; and hence conjectures, that the spots in the sun are a kind of dark smoke, or clouds, floating on the surface of it.

Others will have them stars, or planets, transiting the body of the sun; but it is much more probable they are opaque bodies, in manner of crusts, formed like the scums on the surface of liquors.

Dr. Derham, from a variety of particulars which he has recited, relating to the solar spots, (see *Phil. Trans.* abr. vol. iv. p. 235, &c.) and their congruity to what we observe in our own globe, infers, that they are caused by the eruption of some new volcano therein, which, at first, pouring out a prodigious quantity of smoke, and other opaque matter, causeth the spots: and as that fuliginous matter decays and spends itself, and the volcano at last becomes more torrid and flaming, so the spots decay and become umbræ, and at last faculæ; which faculæ he supposes to be no other than more flaming lighter parts than any other parts of the sun.

Dr. Franklin (in his *Exper. and Observ.* p. 266.) suggests a conjecture, that the parts of the sun's sulphur, separated by fire, rise into the atmosphere, and there being freed from the immediate action of the fire, they collect into cloudy masses, and growing, by degrees, too heavy to be longer supported, they descend to the sun, and are burnt over again. Hence, he says, the spots appearing on his face, which are observed to diminish daily in size, their consuming edges being of particular brightness. For other solutions of these phenomena, by Wilson, Lalande, Herschel, &c., see *MACULE* and *SUN*.

The lunar spots are fixed; and astronomers reckon about forty-eight of them on the moon's face, to each of which they have given names. The twenty-first is one of the most considerable, and is called *Tycho*. See *Nature, &c. of the MOON*.

SPOTS, Circular, in Electricity. See *CIRCULAR Spots and COLOURS*.

SPOTS, Planetary. Astronomers find that the planets are not without their spots. Jupiter, Mars, and Venus, when viewed through a telescope, shew several very remarkable ones: and it is by the motion of these spots, that we conclude the rotation of the planets round their axes, in the same manner as that of the sun is deduced from the motion of his maculæ. See each planet in its proper place.

SPOTS, Lucid, in the Heavens, are little whitish spots, of which there are several, that appear magnified, and more luminous when seen through telescopes; and yet without any stars in them. One of these is in Andromeda's girdle, and was first observed, A. D. 1712, by Simon Marius: it has some whitish rays near its middle, is liable to several changes, and is sometimes invisible. Another is near the ecliptic, between the head and bow of Sagittarius; it is small, but very luminous. A third is in the back of the Centaur, which is too far south to be seen in Britain. A fourth, of a smaller size, is before Antinous's right foot, having a star in it, which makes it appear more bright. A fifth is in the constellation of Hercules, between the stars ζ and ν , which spot, though small, is visible by the bare eye, if the sky be clear and the moon absent.

SPOTSWOOD, in *Geography*, a small town of Middlesex county, New Jersey, near the west side of South river, which discharges itself into the Rariton, in a south-east direction. It is well situated for extensive manufactories; 9 miles S.E. of Brunswick.

SPOTSYLVANIA, a county of the American state of Virginia, bounded north by Stafford, and east by Caroline county. It is hilly, and well watered by branches of the

the Mattapony and Rappahannock rivers. It contains 13,296 inhabitants, of whom 7135 are slaves. At the court-house is a post-office; 78 miles from Washington.

SPOTTED ISLAND, an island in the North Atlantic ocean, on the east coast of Labrador. N. lat. $53^{\circ} 30'$. W. long. $55^{\circ} 20'$.

SPOTTING, FINGER, known also by the name of *Brocading*, in the *Manufacture of fanciful ornamented Cloths*, is a very beautiful, though rather expensive, mode of interweaving flowers, either of the same or different colours, with various kinds of grounds. Of its primary origin we are totally unacquainted, as we find it practised alike, and with little variation of apparent effect, in the silks of Europe and the muslins of India. It is probable that the whole range of fanciful cloths, with which we are acquainted, are originally Asiatic; and that the knowledge of them has gradually reached Europe, at various times, and through various channels. In spots wrought with the shuttle, the flowers being at intervals, and the woof passed across the whole fabric, what passes between the flowers, and is not interwoven with the fabric, must be cut away, when the cloth is taken from the loom, and before it undergoes the succeeding processes of bleaching and dressing. Some specimens of brocaded muslins have been occasionally brought from India, which are entirely effected by a continued and patient exercise of manual labour truly astonishing. The low price of labour paid to the natives of that country may produce these figured muslins, at prices accessible to the opulent natives, and to the more wealthy classes of the European settlers. In this country, even at the most reduced prices, capable of affording to the operative the most penurious and scanty subsistence, they could not be afforded under four or five guineas *per* yard; a sum immensely beyond what could be expected for a commodity so flimsy and perishable as a muslin dress.

In finger-flowers, or brocaded muslins, the draught through the heddles is generally successive from the back to the front, as in most kinds of fanciful weaving. The treddles are moved by the feet, as in the common processes, for forming the plain ground or fabric of the work. For the flowers or raised part, those leaves which require to be raised are most commonly pulled by cords above the weaver's head, as in the diaper and patent draw-loom; and, like them, secured by a knot upon the cord, being fixed in a notch in the board. The weaver then proceeds to pass the substitute, which is to form the flowers, through the warp; each end being separated from, and independent of, all the others. In this he is generally assisted by a boy, who sits at the loom along with him, and who manages one side of the web, while the weaver is employed on the other. From this tedious and laborious operation being done entirely by the fore-finger, the appellation *finger-flower* is derived. Our limits will not allow of a very lengthened detail, nor would it be of any essential service; for, from the causes already assigned, there is no probability of its ever becoming an article of extensive manufacture in this country.

SPOTTISWOODE, JOHN, in *Biography*, a prelate and ecclesiastical historian of Scotland, descended from an ancient family in that country, was born in 1565. His father, who was a minister of Calder, sent him to the university of Glasgow to be educated for the church; and his proficiency in his studies was such, that at the age of eighteen he was thought to be qualified to be his father's successor. When Lodowick, duke of Lenox, was sent, in 1601, on an embassy to France, for the purpose of confirming the ancient amity between the two countries, Spottiswoode, with the hope of conciliating the two na-

tions, accompanied him as chaplain, and returned with him to England. His reputation was at that time so high, that, on the accession of king James to the crown of England in 1603, he was one of the persons appointed to attend his majesty to his newly acquired kingdom; and in the same year he was promoted to the archbishopric of Glasgow, and nominated a privy-counsellor for Scotland. It was the favourite object of James to assimilate as much as possible the church of Scotland to the model of that of England; and archbishop Spottiswoode was very eager in promoting this intention, and is said to have made fifty journeys to London on that account. Having held the see of Glasgow eleven years, he was translated, in 1615, to that of St. Andrews, the metropolitan of Scotland; and he presided at various assemblies for the restoration of the episcopal form of government. He continued in high favour with king James during his whole reign; and Charles I., after his accession, was crowned by him in the abbey church of Holyrood House. In 1635 he was appointed chancellor of Scotland. When the civil commotions broke out in that country in 1639, the archbishop withdrew to England, where he died, and was interred in Westminster Abbey. He was author of "A History of the Church of Scotland," beginning with the year 203, and continued to the end of the reign of James VI., which was published in London in 1655. This work was undertaken at the command of king James, who, when Spottiswoode told him some passages might bear hard on the memory of his mother, said, "Write the truth, and spare not." Spottiswoode was author of "Refutatio Libelli de Regimine Ecclesie Scoticanæ," written in defence of the ecclesiastical establishment of Scotland.

SPOULT, in *Rural Economy*, a word signifying brittle, as applied to wood, &c.

SPOUT, the name of a trunk for conveying water from off the roofs of buildings, which should always be attached to those of the farm-kind. Spouts on such buildings are not only useful for freeing them of water, but in collecting it for the purpose of the live-stock, &c.

SPOUT, or *Water-spout*, in *Natural History*, an extraordinary meteor, or appearance, at sea, and sometimes on land, very dangerous to ships, &c. oftenest observed in hot, dry weather; and called by the Latins *typho*, and *sipho*; by the French, *troupe*, &c.

Its first appearance is in form of a deep cloud, the upper part of which is white, and the lower black. From the lower part of this cloud there hangs, or rather falls down, what we properly call the spout, in manner of a conical tube, biggest at top. Under this tube is always a great boiling and flying up of the water of the sea, as in a jet d'eau. For some yards above the surface of the sea, the water stands as a column, or pillar; from the extremity of which it spreads, and goes off, as in a kind of smoke. Frequently the cone descends so low, as to touch the middle of this column, and continue for some time contiguous to it; though sometimes it only points to it, at some distance, either in a perpendicular, or in an oblique line.

Frequently it is scarcely distinguishable, whether the cone or the column appear the first, both appearing all of a sudden against each other. But sometimes the water boils up from the sea to a great height, without any appearance of a spout pointing to it, either perpendicularly or obliquely. Indeed, generally, the boiling or flying up of the water has the priority, this always preceding its being formed into a column. Generally the cone does not appear hollow till towards the end, when the sea-water is violently thrown up along its middle, as smoke up a chimney: soon after this the spout,

spout, or canal, breaks and disappears; the boiling up of the water, and even the pillar, continuing to the last, and for some time afterwards; sometimes till the spout form itself again, and appear anew; which it sometimes does several times in a quarter of an hour. See a description of several water-spouts by Mr. Gordon, and by Dr. Stuart, in *Phil. Transf. Abr.* vol. iv. p. 103, &c.

M. de la Pryme, from a near observation of two or three spouts in Yorkshire, described in the *Philosophical Transactions*, N^o 281, or *Abr.* vol. iv. p. 106, concludes, that the water-spout is nothing but a gyration of clouds, by contrary winds meeting in a point, or centre; and there, where the greatest condensation and gravitation are, falling down into a pipe, or great tube, somewhat like Archimedes's spiral screw; and, in its working and whirling motion, absorbing and raising the water, in the same manner as the spiral screw does; and thus destroying ships, &c.

Thus, June the 21st, he observed the clouds mightily agitated above, and driven together; upon which they became very black, and were hurried round; whence proceeded a most audible whirling noise, like that ordinarily heard in a mill. Soon after there issued a long tube or spout from the centre of the congregated clouds, in which he observed a spiral motion, like that of a screw, by which the water was raised up.

Again, August 15, 1687, the wind blowing at the same time out of the several quarters, created a great vortex and whirling among the clouds; the centre of which every now and then dropped down, in shape of a long, thin, black pipe, in which he could distinctly behold a motion like that of a screw, continually drawing upwards, and screwing up, as it were, wherever it touched. In its progress it moved slowly over a grove of trees, which bent under it like wands, in a circular motion. Proceeding, it tore off the thatch from a barn, bent an huge oak-tree, broke one of its greatest branches, and threw it to a great distance. He adds, that whereas it is commonly said, the water works and rises in a column, before the tube comes to touch it; this is, doubtless, a mistake, owing to the fineness and transparency of the tubes, which do most certainly touch the surface of the sea, before any considerable motion can be raised in it; but which do not become opaque and visible, till after they have imbibed a considerable quantity of water.

The dissolution of water-spouts he ascribes to the great quantity of water they have glutted; which, by its weight, impeding their motion, on which their force, and even existence, depends, they break, and let go their contents; which generally prove fatal to whatever is found underneath.

A notable instance of this kind we have in the *Philosophical Transactions*, N^o 363, or *Abr.* vol. iv. p. 108, related by Dr. Richardson. A spout, in 1718, breaking on Emmotmoor, near Coln, in Lancashire, the country was immediately overflowed; a brook, in a few minutes, rose six feet perpendicularly high; and the ground on which the spout fell, which was sixty-six feet over, was torn up to the very rock, which was no less than seven feet deep; and a deep gulf was made for above half a mile; the earth being raised on either side in vast heaps. See a description and figure of a water-spout, with an attempt to account for it, in *Franklin's Exp. and Obs.* p. 226, &c.

Signior Beccaria has taken pains to shew that water-spouts have an electrical origin. To make this more evident, he first describes the circumstances attending their appearance, which are the following.

They generally appear in calm weather. The sea seems to boil, and send up a smoke under them, rising in a hill to-

wards the spout. At the same time, persons who have been near them have heard a rumbling noise. The form of a water-spout is that of a speaking-trumpet, the wider end being in the clouds, and the narrower end towards the sea. The size is various, even in the same spout. The colour is sometimes inclining to white, and sometimes to black. The position is sometimes perpendicular to the sea, sometimes oblique; and sometimes the spout itself is in the form of a curve. Their continuance is very various, some disappearing as soon as formed, and some continuing a considerable time. One that he had heard of continued a whole hour. But they often vanish, and presently appear again in the same place.

The very same things that water-spouts are at sea, are some kinds of whirlwinds and hurricanes by land. They have been known to tear up trees, to throw down buildings, make caverns in the earth; and, in all these cases, to scatter earth, bricks, stones, timber, &c. to a great distance, in every direction. Great quantities of water have been left, or raised by them, so as to make a kind of deluge; and they have always been attended with a prodigious rumbling noise.

That these phenomena depend upon electricity, cannot but appear very probable from the nature of several of them; but the conjecture is made more probable from the following additional circumstances. They generally appear in months peculiarly subject to thunder-storms, and are commonly preceded, accompanied, or followed, by lightning, rain, or hail; the previous state of the air being similar. Whitish or yellowish flashes of light have sometimes been seen moving with prodigious swiftness about them. And, lastly, the manner in which they terminate, exactly resembles what might be expected from the prolongation of one of the uniform protuberances of electrified clouds, mentioned before, towards the sea; the water and the cloud mutually attracting one another; for they suddenly contract themselves, and disappear almost at once; the cloud rising, and the water of the sea under it falling to its level. But the most remarkable circumstance, and the most favourable to the supposition of their depending upon electricity, is, that they have been dispersed by presenting to them sharp-pointed knives or swords. This, at least, is the constant practice of mariners, in many parts of the world where these water-spouts abound; and he was assured by several of them, that the method has often been undoubtedly effectual.

The analogy between the phenomena of water-spouts and electricity, he says, may be made visible, by hanging a drop of water to a wire communicating with the prime conductor, and placing a vessel of water under it. In these circumstances, the drop assumes all the various appearances of a water-spout, both in its rise, form, and manner of disappearing. Nothing is wanting but the smoke, which may require a great force of electricity to become visible.

Mr. Wilcke also considers the water-spout as a kind of great electrical cone, raised between the cloud strongly electrified, and the sea or the earth; and he relates a very remarkable appearance, which occurred to himself, and which strongly confirms his supposition. On the 20th of July, 1758, at three o'clock in the afternoon, he observed a great quantity of dust rising from the ground, and covering a field and part of the town in which he then was. There was no wind, and the dust moved gently towards the east, where appeared a great black cloud, which, when it was near its zenith, electrified his apparatus positively, and to as great a degree as ever he had observed it to be done by natural electricity. This cloud passed its zenith, and went gradually towards the west, the dust then following it, and continuing to rise higher and higher, till it composed a thick pillar, in the form

of a fugar-loaf, and at length seemed to be in contact with the cloud. At some distance from this there came, in the same path, another great cloud, together with a long stream of smaller clouds, moving faster than the preceding. These clouds electrified his apparatus negatively, and when they came near the positive cloud, a flash of lightning was seen to dart through the cloud of dust, the positive cloud, the large negative cloud, and, as far as the eye could distinguish, the whole train of smaller negative clouds which followed it. Upon this the negative clouds spread very much, and dissolved into rain, and the air was presently clear of all the dust. The whole appearance lasted not above half an hour. See Priestley's *Electr.* vol. i. p. 438, &c.

This theory of water-spouts has been farther confirmed by the account which Mr. Forster gives of one of them in his *Voyage round the World*, vol. i. p. 191, &c. On the coast of New Zealand he had an opportunity of observing several, one of which he has particularly described. The water, he says, in a space of fifty or sixty fathoms, moved towards the centre, and there rising into vapour, by the force of the whirling motion, ascended in a spiral form towards the clouds. Directly over the whirlpool, or agitated spot in the sea, a cloud gradually tapered into a long slender tube, which seemed to descend to meet the rising spiral, and soon united with it into a straight column of a cylindrical form. The water was hurled upwards with the greatest violence in a spiral, and appeared to leave a hollow space in the centre, so that the water seemed to form a hollow tube, instead of a solid column; and that this was the case, was rendered still more probable by the colour, which was exactly like that of any hollow glass tube. After some time, this last column was incurved, and broke like the others; and the appearance of a flash of lightning which attended its disjunction, as well as the hail-stones which fell at the time, seemed plainly to indicate that water-spouts either owe their formation to the electric matter, or at least that they have some connection with it.

Mr. Cavallo (*Elem. of Phil.* vol. ii.) has detailed the following facts, as the most remarkable, relative to water-spouts.

Two or three, or more, water-spouts are frequently seen within the space of a few miles, and they are mostly seen at sea.

Their size is various, not exceeding, however, a few feet in diameter; and the same water-spout sometimes increases and decreases alternately; it also appears, disappears, and re-appears, in the same place.

The water-spout sometimes proceeds a little way from a cloud, or a little way from the sea; and often those two short and opposite spouts are not only directed towards each other, but they are extended, and meet each other.

When it proceeds from the sea, the water about the place appears to be much agitated, and rises a short way in the form of a jet, or spray, or steam, in the middle of which a thick, well defined, and generally opaque body of water rises, and proceeds to a considerable height into the atmosphere, where it is dissipated into a vapour, or it seems to form a cloud.

When it proceeds from a cloud, the clouds about the spot frequently appear much agitated, and an agitation of the water immediately under the spot is generally seen at the same time.

The water-spout is frequently seen to have a spiral or screw-like motion, and sometimes is attended with considerable noise.

Some of them stand in a perpendicular direction, others

are inclined, and some water-spouts form a curve, or even an angle.

The water-spouts generally break about their middle, and the falling waters occasion great damage, either to ships that have the misfortune of being under them, or to the adjoining land; for such spouts are sometimes formed on a lake or river, or on the sea close to the land.

Sometimes the water-spouts are seen where there is no appearance of whirlwind, or where the wind, at least to a spectator at some distance, appears to blow regularly one way.

The oblique spouts almost always point from the wind; for instance, when the wind is N.E. the spout will point to the S.W.

The water-spout has been attributed principally, if not entirely, to the meeting of different winds. In that case, the air in its rotation acquires a centrifugal motion; whence it endeavours to recede from the axis of the whirl, in consequence of which a vacuum, or, at least, a considerable rarefaction of air, takes place about the axis; and, when the whirl takes place at sea, or upon water, the water rises into that rarefied place, for the same reason which causes it to ascend into an exhausted tube, and forms the water-spout or pillar of water in the air: nevertheless it is observed by Mr. Cavallo, that the various appearances of water-spouts do not seem to be quite reconcilable to the above-mentioned theory. Several ingenious persons have considered the water-spout as an electrical phenomenon; having observed, that thunder-clouds and lightning have been frequently seen about the places where water-spouts appear, and likewise that by means of artificial electricity, a water-spout may in some measure be imitated. (See the preceding part of this article.) Mr. Cavallo, however, suggests, that the lightning and other electrical phenomena appear to be rather the necessary consequence than the cause of the water-spout; it being well known that electricity is produced whenever water is reduced into vapour, or vapour is condensed into water. A water-spout of the most complete form is represented in *Plate XXIV. Miscellany, fig. 8.*

In Pliny's time, the seamen used to pour vinegar into the sea, to alluage and lay the spout, when it approached them: our modern seamen think to keep it off, by making a noise with filing and scratching violently on the deck, or by discharging great guns to disperse it.

SPOUTING FOUNTAIN. See FOUNTAIN.

SPOUTY Ground or Land, in *Agriculture*. See SOIL, and SPRING-Draining.

SPRAGGE, Sir EDWARD, in *Biography*, a celebrated naval hero and commander, of whose early history nothing has been collected, but who deserves a place in the annals of England, and whose services will be ever remembered with gratitude by his country. He is compared by Campbell to Alcibiades, who was equally able and esteemed in the camp, in the court, and in the closet. "In every character which he assumed, he so far excelled as to seem born and designed for that alone. The same thing his contemporaries, his companions, those who knew him, and the world too, perfectly well, affirm of Sir Edward Spragge, who with a fine person, and gentle temper, had as solid an understanding, and as bold a spirit, as any counsellor or captain of that age. With all these advantages, with the favour of the duke of York, with the merit of great services which he rendered his country, and with the still greater merit of dying gloriously in his country's service, which, indeed, procured him remains an interment in Westminster Abbey, he was not honoured with a tomb; or any memorial, as far as

I can

I can discover, where he was born, of what family, or how he attained his first preferment."

We find him a captain in the first engagement with the Dutch, after the restoration of Charles II., viz. on the 3d of June, 1665, in which he behaved with great reputation, and on account of which he was knighted. He was likewise in the four-days' battle in June 1666, at which time he was particularly noticed by the duke of Albemarle; and in the succeeding battle, which was fought on the 24th of July, he carried a flag under sir Jeremiah Smith, admiral of the blue squadron, who engaged Van Tromp, shattered his vice admiral, so that she was absolutely disabled, and having ruined the rigging of the rear admiral, and killed the commander, contributed very much to the glory of that day. He greatly distinguished himself when the Dutch daringly ventured up the Thames in 1667: he was employed on this occasion to maintain the fort of Sheerness, which he defended with gallantry, till it would have amounted to an act of rashness to expose his garrison any longer: and when he could act no more by land, he began to collect as great a force as possible by sea. This amounted to no more than five frigates, seventeen fire-ships, and some tenders; and yet when the Dutch admiral Van Nes came up the river, sir Edward engaged him, and burnt eleven or twelve of his ships, with only six of his own. The wind, after this, obliged him to shelter himself from the enemy's superior force, under the cannon of Tilbury fort. The next day, the weather being more favourable, he again attacked the Dutch, and drove them disgracefully out of the river.

In 1671 he was employed against the Algerines, and destroyed seven of their men of war, and did them other damage which was esteemed irreparable. They had picked out their chief and most renowned commanders, on purpose to meet sir Edward Spragge; had furnished them with their best brass ordnance from on board all the rest of their vessels, with nearly 2000 chosen men double officered, of whom about 400 were killed, the castles and towns miserably torn, and a vast number of people in them slain and wounded; and, which increased the misfortune, all their surgeons' chests were burnt on board their ships, so that numbers died for want of having their wounds dressed. In this engagement sir Edward Spragge had but 17 men killed, and 41 wounded. Dr. Campbell mentions it as honourable to the English name and heroism, that in all our wars with the pirates of Algiers at that period, the Spaniards allowed us the free use of the harbour of port Mahon, as to the champions of the Christian cause, and protectors of the commerce of the Mediterranean, and thither sir Edward repaired to refit before he returned home.

Sir Edward Spragge was raised to the rank of admiral of the blue in the year 1673, having in the preceding year been employed by the duke of York to assemble the fleet in order to attack the Dutch, and in that year he was present in the Solebay fight, May 28th, and in it distinguished himself by sinking a Dutch ship of sixty guns.

Before the fleet put to sea in 1673, sir Edward was sent, with the character of envoy extraordinary, to France, where he was received with all possible respect, and at his taking leave, had a present made him of great value.

On the 28th of May, 1673, he took a most gallant part in the engagement with the Dutch: he fought Van Tromp seven hours, forced him from the Golden Lion into the Prince on Horseback, and thence into the Amsterdam, and from that into the Comet, where he would have been killed or taken if he had not been relieved by De Ruyter. Sir Edward also twice changed his ship. These circumstances

were not mentioned in the account published by order of government, but the matter is fairly stated by prince Rupert, notwithstanding there had been a private quarrel between the prince and admiral. "Sir Edward," says his highness, "did on his side maintain the fight with so much courage and resolution, that their whole body gave way to such a degree, that, had it not been for fear of the shoals, we should have driven them into their harbours, and the king would have had a better account of them."

On the 4th of June he behaved with great resolution, forced Van Tromp to change his ship twice, and finally obliged him to retreat. In the third battle, which took place on the 11th of August, sir Edward Spragge, with the blue squadron, was in the rear, but being provoked by Van Tromp, he laid his fore-top sail to the mast to wait for him, and having engaged his squadron, continued fighting many hours, at a distance from the body of the fleet. Sir Edward was at first on board the Royal Prince, and Van Tromp in the Golden Lion; but after a dispute of about three hours, sir Edward's ship was so disabled, that he was forced to go on board the St. George, as Van Tromp for the same reason went on board the Comet. Then the fight between them began again with greater fury than before: at last the St. George was so battered, that sir Edward thought it right to leave her, in order that he might go on board the Royal Charles; but before his boat had rowed many yards it was pierced by a cannon shot, and the admiral was drowned.

Bishop Parker describes this last scene in the following words: "There was a remarkable fight between Spragge and Van Tromp; for these having mutually agreed to attack each other, not out of hatred, but through a thirst of glory, they engaged with all the rage, or, as it were, with all the sport of war. They came so close to one another, that, like an army of foot, they fought at once with their guns and swords. Almost at every turn, both their ships, though not sunk, were yet bored through and through, their cannon being discharged with common gun-shot: neither did our ball fall in vain into the sea, but each ship pierced the other, as if they had fought with spears. But at length, three or four ships being shattered, as Spragge was passing in a long boat from one ship to another, the boat was overturned by a chance-shot, and that great man, not being skilled in swimming, was drowned, to the great grief of his generous enemy, who, after the death of Spragge, could hardly hope to find an enemy equal to himself. But thus it happened, that when that brave man had overcome so many dangers, his country being now victorious and safe, no honour remained for him to receive, but the reward of a glorious death." The bishop adds, in another part of his history, that sir Edward Spragge was a person the love and delight of all men, as well for his noble courage, as the gentle sweetness of his temper. See Stockdale's edition of Campbell, vol. ii.

SPRAIN, in *Surgery*, signifies an injury done to a joint, which has had its ligaments violently stretched, without there being any sensible luxation.

The motion of the articulations cannot be carried beyond their natural limits, without the ligaments, intended for uniting the bones and bounding their movements, being either forcibly stretched or lacerated. A sprain, therefore, is always accompanied with the first of these circumstances, and sometimes with the second.

Custom has limited the term *diastasis* to the lateral separation of two long bones, articulated together by corresponding surfaces at their extremities, and, especially, to such injuries,

SPRAIN.

juries, when they affect the immoveable joints, like those betwixt the tibia and fibula, those betwixt the bones of the pelvis, &c. But, as Boyer has observed, it is plain that these accidents do not at all differ from common sprains, since they cannot happen without a violent stretching and even a rupture of the ligaments.

The orbicular joints, those which allow to the bones the most varied and extensive motions, are so disposed, that their ligaments, which are protected by a great number of powerful muscles, can only suffer a considerable extension by an extraordinary effort; and when it is adequate to produce this extension and rupture of the ligaments, the displacement which follows is necessarily permanent, in consequence of the spherical form of one of the articular surfaces; which form will not permit a spontaneous reduction.

On the contrary, in the ginglymoid joints, and those which resemble them in the trivial degree of their motions, which are usually limited to two alternate directions, and sometimes very obscure, the natural relations of the bones are assured by the disposition of the articular surfaces themselves, and by the strength of the ligaments, but hardly at all by the muscles. The action of these last organs, consequently, not increasing the resistance made by the ligaments in cases of necessity, in proportion to the violence which operates, the latter parts are the more apt to be stretched and ruptured. On the other hand, as the surfaces of these joints are generally extensive, and cannot be forced away from each other without great difficulty, the effort which tends to separate them, for the most part only occasions a stretching and rupture of the ligaments. Hence, dislocations are very common in the orbicular joints, and sprains are most frequent in those of the ginglymoid kind. The ankle joint, which affords a striking instance of the conditions just now explained, and which is besides exposed to considerable and frequent shocks, is also that in which sprains are most observed. Then follow the articulations of the bones of the tarsus, of the wrist, knee, and elbow, in which last a sprain is not so often met with, notwithstanding the suitable dispositions in appearance; for the ligaments which strengthen this joint being extremely strong, an excessive violence is requisite to stretch or break them, and then it is always capable of also occasioning a dislocation.

The differences of sprains depend upon the importance of the joint, the degree of violence which has been applied, and the extent of the disorder attending these cases. Consequently, some sprains are slight, the ligaments having been merely stretched, while others are severe, the ligaments and surrounding cellular substance having been lacerated, and the tendinous nerves and vessels of every kind, and even the skin itself, more or less violently stretched.

When a sprain occurs, the external violence which produces it, must either act so as to carry the motions of a ginglymoid joint beyond their natural limits; or so as to cause movements in a direction in which they are not natural; or, lastly, so as to make a joint move, which in the natural state performs no motion whatsoever. Thus, in a fall upon the hands, where the extension or flexion of the wrist is forced, a sprain is very liable to happen. In a fall upon the feet, where one of the two, being in the state of adduction, or abduction, supports nearly the whole weight of the body; also in falls backward, where the point of the foot is so locked as not to allow any motion of the leg backward; and when the sole of the foot is twisted inward while a patient is running quickly; the ankle, or joints of the tarsus, or all together, are liable to be sprained. With regard to the ankle, it may be remarked, that there are cases, in which a predisposition to serofula acts also as a predis-

position to sprain. We allude to instances, in which the articular extremities of the long bones having been enlarged at an early period of life, the ligaments of the neighbouring joint have suffered a considerable elongation, or relaxation. This occurrence, which is particularly observable at the lower end of the tibia, makes the foot flat, and its articulation much freer and weaker than it ought to be; and patients who are thus formed, are also more subject to sprains. Under these circumstances, it is not uncommon to see the same accident happen several times to the same joint. With respect to the sort of injury which has received the name of *diastasis*, it is difficult to comprehend the possibility of it, unless combined with a fracture of one of the two bones. In taking for example the bones of the leg, it is difficult to conceive how the lower articulation of the tibia with the fibula can be affected by external violence; how the surfaces of this joint can be separated, its ligaments elongated or ruptured, without there being at the same time a fracture of the fibula. It is an accident which to Boyer seems very difficult to prove. A mere separation of the articular surfaces, without fracture, would hardly admit of detection, because the swelling, which takes place almost immediately, must hinder the examination of the parts. Boyer thinks it extremely probable, that, in many cases, the consequences of an undiscovered fracture of the fibula have been mistaken for the consecutive proofs of a *diastasis*.

Sprains are accompanied with a variety of symptoms, amongst which pain and swelling come on immediately. It is easily comprehensible, that the ligaments, and other soft parts which surround a joint, cannot be stretched and more or less torn, without an instantaneous pain being excited proportionate to the sensibility of these parts, and the degree of violence which they have sustained. The pain and irritation are soon followed by swelling, which, from being at first inconsiderable, afterwards increases, and at the end of four and twenty hours it is usually at the highest degree, and exhibits signs of the presence of inflammation. The blood, which escapes from the small ruptured vessels, passes into the cellular substance, and occasions an ecchymosis, which sometimes extends a great way. Immediately after the accident, the joint is capable of performing all its motions; but, as soon as the swelling has taken place, these motions are impeded, and, on force being used to make the joint move, acute pain is produced, and the case is rendered worse.

When a sprain is slight, it is a disease of little consequence, and easily cured. The pain gradually diminishes, the swelling and tension disappear, the ecchymosis is dispersed, the motion of the limb is restored, becoming daily more and more extensive, and the joint in due time returns to its natural state. But when a sprain happens to a joint, the motion of which is naturally very confined, and which is strengthened by exceedingly strong ligaments, whose resistance can be overcome only by great violence, the symptoms are generally very severe, and disappear much more slowly. Then, according as the ligaments have suffered more or less, and as the swelling of the soft parts has been more or less considerable, sometimes the joint remains affected with a weakness, which renders it particularly susceptible of the same accident; sometimes it contracts a stiffness, which renders all motion extremely difficult, and which does not go off till after a very long while; and, indeed, occasionally, such rigidity lasts during life.

In subjects who are well formed, and free from all constitutional disease, it seldom happens that a sprain, even the most considerable, has any other consequences but those which have just now been described. Serious errors in the

treatment, however, and particularly the unmanageableness and imprudence of patients, who fatigue the joint in using it too soon and before the pain is over, may render a sprain very bad even in subjects who are in other respects perfectly sound. In this case, sometimes the pain and swelling, after having undergone a greater or lesser abatement, still continue in a degree, so that a disease, which might have been cured in five or six weeks, lasts five or six months, and frequently a whole year. Sometimes the symptoms get worse instead of becoming better. The pain and swelling occur in the highest degree, and suppuration itself, followed by caries of the bones, may follow, and even create a necessity for amputation in order to save the patient's life.

But symptoms of this violent nature are seldom remarked after sprains, except in subjects who labour under some constitutional disorder, which may extend its effects to the joints. The most common, and at the same time the most afflicting, is scrofula. In patients disposed to this disease, sprains often become the occasional or exciting cause of white-swellings, which too frequently baffle all the efforts of the most skilful surgeons, and make amputation indispensable.

The symptoms which characterize sprains are easy of comprehension. An application of external violence, the nature and direction of which are always known; a more or less acute pain in the affected joint, without deformity, without any manifest alteration in the natural relations of the articular surfaces; a free power of motion immediately after the accident; and a sudden swelling proportioned to the violence of the shock. Such are the circumstances denoting a sprain. A sprain may readily be distinguished from every other affection of the joints. Uninformed practitioners have been known, however, to mistake its nature, and thence do considerable mischief, by ill-judged attempts to remedy a separation of bones, or to reduce a dislocation which never existed. So gross a mistake may easily be avoided by the least attention.

The prognosis of sprains differs according to the degree of the injury, the nature of the joint, and the particular constitution of the patient. A slight sprain is a case of little importance, being generally cured in a few weeks, when properly treated, and when the patient, obedient to the advice of the surgeon, keeps the joint perfectly motionless, and avoids using the limb until the pain and swelling are entirely removed. A violent sprain, occurring to a joint that is strengthened by very strong ligaments, like that of the ankle for example, is a severe case, which often lasts several months, and which, as we have already explained, may have afflicting consequences, when it is badly treated, or the patient does not conform to the advice of his surgeon. Even a slight sprain is always a severe accident in scrofulous subjects, because it may become an exciting cause of a white-swelling, and produce a necessity for amputation.

The treatment of sprains consists in preventing the inflammatory swelling, dispersing it when it has taken place, promoting the union of the torn ligaments, and re-establishing the tone, force, and freedom of motion in the affected joint.

Experience has taught, that cold water is the best application which can be used for fulfilling the first indication. This discutient appeases the pain, and tends to prevent swelling and inflammation. Cold water is rendered more sedative and efficacious, when a little of the liquor plumbi acetatis is added to it. Thus, when a surgeon is consulted immediately after the accident, the part should be immersed in a pail of spring water, into which the liquid acetate of lead has been put in the proportion of a drachm to a pint.

Some practitioners make the quantity greater; but, we believe, what is here mentioned is quite sufficient. In order to derive all the advantage possible from the employment of cold water, the part should remain immersed several hours without interruption, and the water should be changed as soon as it becomes warmed. Boyer does not approve, however, of using this application for women who have their menses on them; or for patients whose lungs are weak, or who are subject to hæmoptysis; or for any persons who are in a great perspiration. Perhaps, in such instances, it may be as well to use a warm linseed poultice.

After the part has been taken out of the water, it is to be covered with linen wet with the same application, and care must be taken frequently to wet the cloths anew, so that they may be as cold as possible, and the evaporation effectual.

When the sprain is slight, discutients are commonly adequate to the prevention of the inflammatory swelling, and they may be continued till the case is quite well. But if the injury be too severe to yield to these means, or should they not have been tried in the first instance, so that tension and swelling have already come on, recourse must be had to the means proper for fulfilling the second indication, that is to say, for dispersing the pain and inflammatory swelling. The patient may be bled more or less copiously according to his age, strength, constitution, and severity of the accident. Low diet and absolute rest are to be directed, and topical emollient anodyne applications are to be made to the part affected; such as linseed poultices, and fomentations of white poppy-heads. When the pain is excessively severe, a small quantity of laudanum, or of a watery solution of opium, may be mixed with the poultice.

The use of these local applications is to be continued as long as the pain and swelling exist; but as soon as they are removed, discutients must be employed; such as camphorated spirit of wine, soap liniment, ammoniated oil, and many kinds of mineral waters.

During the whole treatment, and even a long while afterwards in severe cases, the part affected must be kept strictly at rest. On one hand, moving the joint might keep up the irritation and inflammation; on the other, when the sprain has been considerable and the ligaments lacerated, a firm union of them, and the return of the strength which is essential to the perfect functions of the articulation, can only be obtained by long rest.

When a sprain happens to the ankle, as is most common, the patient should not be suffered to walk before the pain and swelling are entirely removed. As there remains in the joint almost always a weakness, which subjects the patient to the same accident again, when he walks too quickly, or carelessly, it is proper, with a view of obviating this inconvenience, to apply a moderately tight roller to the part, or to direct him to wear for some time a laced soft leather buskin.

It frequently happens, after the cure of a sprain, when the joint has recovered all its strength and freedom of motion, that the surrounding cellular substance is puffy and œdematous, especially in the evening, after the patient has been long in the erect position. The most efficacious means which can be used against this local infirmity, which may continue a long while, is the compression of a bandage, or laced dog-skin stocking.

In other cases, the ligaments, which have been violently distended and lacerated, become rigid, and the motion of the joint remains imperfect. Here fomentations, emollient baths, vapour baths, and oily liniments, are indicated.

Lastly,

Lastly, when the stiffness of the joint resists these means, the efficacy of hydro-sulphurated waters may be tried.

In scrofulous subjects, sprains may be followed by the most severe consequences, as already related, and may become the existing cause of an inveterate disease of the joint. The consideration of the treatment of the disorder here alluded to, will be found in a future article of this publication. (See WHITE-SWELLING.) Boyer *Traité des Maladies Chirurgicales*, tom. iv. ch. 1.

SPRAIN, among horses, and other sorts of live-stock, a violent extension of some tendinous part, by which sudden lameness is not unfrequently produced. It is mostly capable of being removed by saturnine, spirituous, or acid washes, with proper elastic bandages, and a little rest. It often happens in the legs of horses, and some other animals.

SPRAIN, in *Agriculture*, a term applied to the sowing of seeds by hand, signifying to throw them into their places with a single motion of the hand, at a certain distance from one another. It is particularly applied to beans, and some other kinds of seed. Spraying in crops is not unfrequently practised in particular places where labour is cheap.

SPRAINTS, among *Sportsmen*, a term used for the dung of the otter.

SPRANGENBERG, in *Geography*, a town of the principality of Hesse Cassel; 6 miles S. of Lichtenau.

SPRANGER, BARTHOLOMEW, in *Biography*, was the son of Joachim Spranger, a merchant of eminence at Antwerp, and was born there in 1546. As he exhibited an inclination for painting, he was placed as a disciple with John Madyn, a painter of some reputation at Haerlem, and afterwards with Francis Molaert. He then went to Italy through France, and resided some years at Parma as a student, under Bernardino Gatti, who had been a disciple of Correggio. He thence went to Rome, where the cardinal Farnese favoured him with his patronage, and engaged him to paint, in the Villa Caprarola, several landscapes in fresco. By the cardinal he was introduced to the pope, Pius V., who appointed him his painter, and gave him apartments in the Palazzo Belvidere. His first work for his holiness was a picture of the Last Judgment, a composition of five hundred figures, painted upon a copper-plate six feet high. This picture is said to have taken him three years to complete, and to have been, of course, finished with great care; and in consequence of its being highly esteemed by the pope, it was placed upon his tomb, after his decease. The same kind patron commissioned him to paint twelve pictures of the passion of our Saviour, but did not live to witness their completion.

The renown of Spranger now reached the court of Vienna, to which he was invited by the emperor Maximilian II. in 1575, and appointed his principal painter. On that emperor's death in the following year, his successor, Rodolphus II., continued to shew the same favour to Spranger, and engaged him in several works of importance both at Vienna and at Prague; respecting him highly, not only for his abilities as a painter, but also for his literary acquirements, and other accomplishments. In 1588 he was ennobled by his imperial majesty, who honoured him by placing round his neck, with his own hands, a chain of gold, with a medal attached to it. Spranger died at Prague, in 1623, aged 77.

The style of this painter is that which was built upon the defects of Michael Angelo, or rather in the perversion of his style, by a crude and indigested adoption of its most prominent character, without the judicious taste and feeling in which it originated. It was consequently extravagant

and bombastic, presenting inflated muscles, and knobby excrescences for bones, redeemed only in some eyes by a lively fancy, an agreeable facility of execution, and a pleasing colour.

SPRAT, THOMAS, bishop of Rochester, a writer of considerable eminence in the 17th century, was born in 1636 at Tallaton, in Devonshire, where his father was a clergyman. He received his academical education at Wadham college, Oxford, of which Dr. Wilkins was then warden, under whom he acquired a proficiency in mathematical knowledge. In 1657 he was elected a fellow of his college; and on the death of Oliver Cromwell, he gave a specimen of his poetical talents in an "Ode to the happy Memory of the late Lord Protector," addressed to Dr. Wilkins. This ode was followed by one on the "Plague of Athens," which, as well as the former, afforded proof of a warmth and readiness of conception. At the Restoration, like many others, he made a short turn, and atoned for his former delinquency by zealous loyalty, and was made chaplain to the duke of Buckingham, who was his zealous friend and patron. He was chosen a member of the Royal Society, which was then in its infancy, and which had originated from the meetings of the scientific men held at the lodgings of Dr. Wilkins, in Wadham college. In 1667 Sprat published the history of this society, and its foundation; and obtained a high reputation for the elegance of the style and sentiment exhibited in the work. He had published, two years previously to this, "Observations on Sorbiere's Voyage to England," which were well received, and considered as a seasonable castigation of a superficial foreigner who had vilified the country. In 1668 he was editor of Cowley's Latin poems, to which he prefixed a life of the author, in the same language. This he afterwards enlarged in English, and annexed to the English works of that poet. He had now attained a degree of reputation, which, joined to his talents for conversation and society, caused him to be rapidly advanced in the career of preferment. He was successively made a prebendary of Westminster, rector of St. Margaret's, canon of Windsor, dean of Westminster, and finally, in 1684, was raised to the episcopal bench as bishop of Rochester. This last preferment was considered as a reward for the service of drawing up, at the command of the king, an account of the Rye-house plot. This was first printed in 1685, and was reprinted in the following year, after James II. had succeeded to the throne. The manner in which he had executed this task rendered it expedient for him to publish an apology, after the Revolution. He had reflected on the characters of those, whose names have been long ranked among the martyrs to liberty. Of lord Russell, Sprat observes, "that he was carried away into this traitorous conspiracy from a vain air of popularity, and a wild suspicion of losing a large estate by an imaginary return of popery." His favour under the new reign was manifested by his appointment to the place of clerk of the closet to the king, and his nomination as one of the commissioners for ecclesiastical affairs. At the revolution he submitted to the new government, and was allowed to remain unmolested in his see. His principles, however, being well known, he was involved, in 1692, with others, in an information laid before the privy council, of a pretended conspiracy for restoring king James. He detected the infamy of the informers, and effectually cleared himself from the charge; but he was so much affected by the danger he had undergone, that he ever after commemorated his deliverance by annual thanksgiving. He passed the rest of his life in the practice of professional duties and virtues, by which he engaged the esteem and af-

fection of those with whom he was connected, and died in 1713, in the 79th year of his age. Besides the works already mentioned, he published a relation of his examination before the privy council, two letters to lord Dorset, and a volume of sermons. Biog. Brit.

SPRAT, in *Ichthyology*, a species of the clupea, with the lower jaw the longest, and the belly very acute, and the dorsal fin consisting of thirteen rays. See CLUPEA.

The sprat, or *clupea sprattus* of Linnæus, has generally, but erroneously, been supposed a herring not grown to its full size. Its usual length is about four or five inches, and the body much deeper than that of a young herring of equal length; the back fin is placed more remote from the nose than that of the herring: but one great distinction between this fish, the herring, and the pilchard, is the belly; that of the two first being quite smooth, that of the last very strongly serrated; and another is, that the herring has fifty-six vertebrae, this only forty-eight. Besides, sprats visit our coasts, and continue with us in large shoals, when the others, in general, have retired to the great northern deeps. They come into the river Thames, below bridge, in the beginning of November, and leave it in March, and are, during their season, a great relief to the poor of the capital. At Gravesend and at Yarmouth they are cured like red herrings: they are sometimes pickled, and are little inferior in flavour to the anchovy, but the bones will not dissolve like those of the latter. Pennant.

SPRATT, in *Agriculture*, a name applied in some places to a plant, which is found to rise in great abundance, in a spontaneous manner, in most watery situations of the more found boggy kind. It is stated in a paper in the third volume of the "Transactions of the Highland Society of Scotland," that though it abounds much in that part of the kingdom, the proper culture of it is by no means well understood. It should, it is said, be suitably manured for with compost manure, once in three years; or watering sometimes answers the same intention very well, in cases where it is grown for hay; the land being preserved from cattle, or other sorts of stock, from the month of March; and the plants cut for hay in July at the latest. The feeding stalks are also stated to have been mown, after the cattle in pasturage, to benefit.

The spring frosts occasionally, however, destroy some inches of the tops of the plants.

Sheep may safely eat it, without danger of rotting them; and it raises young cattle, it is said, to a great size of bone. But that when suffered to run up to seed, it is not palatable; though cattle not unfrequently get it for hay in that state. Where manure is used, and it is cut in the sap, it constitutes, it is observed, a most excellent and abundant kind of hay for black cattle. In this management, it has been seen ready for the scythe as soon as rye-grass; and one of the best samples of meadow hay seen in the above part of the country was cut in the year 1804, and consisted of spratt and common poa.

Others, however, do not think so highly of it, as it has been noticed in situations in the Highlands, where cattle were often stinted or straightened for food, and generally remained untouched by them. The same has likewise been the case in other places of the above districts.

Its strong root is also thought an objection to its being cultivated as a grass-crop, even if it were capable of it, as being difficult of extirpation.

It has been farther used for making cushions, to be put under the yokes used by oxen in ploughing; for which purpose it seems, it is said, well suited, on account of its toughness. See JUNCUS.

SPRAWL, *To*, in *Military Language*, is to widen out in an irregular and unfoldier-like manner: a term chiefly applicable to the cavalry.

SPRAWLING CHARGE, a loose and irregular movement of cavalry, instead of a close, compact, forward attack.

SPRAY, in *Sea Language*, denotes the sprinkling of the sea, which is driven from the top of a wave in stormy weather. It differs from spoon-drift, as being only blown occasionally from the broken surface of a high wave, whereas the latter continues to fly horizontally along the sea, without intermission, during the excess of a tempest or hurricane. Falconer.

SPRAY, in *Agriculture*, the twiggy branches of any sort of underwood, which are useful for many different purposes. The spray of many extensive woods, in different places, are cut over occasionally for burning lime, &c.

SPRAY-Faggots, such as are made from the spray or small branches, and other offal, of different kinds of wood of the undergrowth kind, and bound up in proper quantities. This sort of faggot, as well as those which are made of furze, and some other inflammable matters, are much employed in burning chalk into lime, in what are called flame-kilns, in some districts, as in Sussex, &c.

SPREADING and setting out Manure, the practice of dispersing and distributing it in or upon land, and putting it on in a proper manner for the purpose. This sort of work is performed somewhat differently on arable or grass-land, and according to the nature of the cultivation. This can never be done in the most proper and complete manner, unless the necessary attention has been bestowed in setting the manure out, to see that it is not deposited in too large heaps, but put out in equal proportions, of a moderate size, at pretty exact distances between the different heaps. In the business of setting out manure to the greatest advantage, the carts employed should be rather small, and conveniently formed for the purpose. With large carts the work is liable to be done not only with much inequality, but in far too large heaps, so that it is done with great trouble and loss of time. Single-horse carts are perhaps, in general, the most useful in this way or intention.

The writer of the corrected account of the Agriculture of the County of Perth, has noticed an ingenious contrivance for facilitating the unloading of carts filled with substances of the manure kind, which is in use in that district. It consists in suspending the box or body-part of the cart at different heights, while it is emptying; but it can only be used with advantage in carts which are constructed on a sort of moveable frame, or those which are denominated coup-carts, and where the load is to be discharged in several different portions. For this purpose a thin piece of iron, of about two inches in breadth, is fixed on the fore-part of the box or body of the cart, exactly in the middle, extending in length to the top or height of the body or box-part, in which are formed and inserted three or four oblong holes, corresponding in size to a rod or pin, which is fixed with a staple in the middle of the first bar that keeps the shafts of the cart together. The length of this rod or pin is mostly about eighteen inches, but longer when necessary, as the height or length of that part of the body or box of the cart which rests on the frame may require. The top part of it is formed into somewhat the shape of a crescent, an inch in width, with the point upwards, which corresponds with the holes in the iron plate. When the rod or pin is not in use, in order to prevent its dangling, it is made to rest on a hook in the front of the box, or body of the cart. When the driver wishes or is desirous to unload a part of

the contents of the cart, he raises the box or body-part of it, putting the rod or pin into the first nick or hole, and makes the first heap; and then moves on to the place or distance where he intends to put down the second, when he again raises the same part of the cart to the second nick; continuing the same method until the whole of the contents be discharged or set out.

In spreading out manure on the surface of arable land, where it is to be turned into the soil by the plough, so much exactness is not necessary; though it should always be done in as even and regular a manner, and to as equal a thickness, as possible. And on ridges, especially where they are rather narrow, care should be taken that it does not fall into the ridge-furrows, by carefully spreading it out at first all along the borders of them in a regular manner. In cases where it is to be placed and spread out in drills or furrows made for the purpose, it should constantly be executed in as even a manner, in regard to thickness, as it will readily permit, and in a way which will allow of its being covered in as completely as possible, as it is equally wasteful and disgraceful to have it presenting itself externally.

In spreading different sorts of materials of the manure kind over grass-land, it is always necessary to see that the work be performed in an exact and even manner, as well as that all the lumps and clods be well broken down, and as much reduced as possible, by beating them with the fork or shovel, or in some other way. On arable as well as grass-land, as favourably dry a season as can be obtained should mostly be chosen for this sort of work. In wet seasons, the materials clog and hang about the feet and tools of the workman, and are never capable of being so divided as to be spread out with the necessary degree of evenness and regularity, especially on grass-land. On this sort of land, when the heaps have been set out, they should never be suffered to remain so long as is too frequently the case, before they are spread out, as the grass-plants underneath them become blanched and tender, and are liable to be destroyed; great injury being often done to the surface or sward, in such cases. In spreading manure from the carts, injuries of this nature are likewise prevented, as is found in the midland and some other districts, where the practice prevails; but in this mode, it is probable, the work can neither be performed in so perfect a manner, nor with so much economy of time and labour. In this manner, the inconvenience of hill or heap-steads will, however, be avoided; and, of course, the disadvantage of their getting too large a proportion of manure guarded against and prevented.

The tools mostly employed in this sort of work are those of the dung-fork and the shovel, but others are occasionally used for particular sorts of manure.

After the substances of this kind have been spread out in this manner on grass-land, they may often be farther usefully reduced and distributed, by passing a bush-harrow over them a few times in a dry season, some weeks after the spreading has been performed.

Where manure, in its more recent or fresh state, is employed either on arable or grass-land, more attention will be necessary in spreading it out over or into the land, so that it may be done in an even and perfect manner. See *YARD-DUNG*.

SPREE, or **SPREME**, in *Geography*, a river which rises on the frontiers of Bohemia, crosses Lusatia, enters the marquisate of Brandenburg, and, after passing by Berlin, joins the Havel at Spandau.

SPREMBERG, or **SPREHENBERG**, or *Grodtk*, a town of Lusatia, on the river Spree, which gives name to a circle, or district; 29 miles S.S.W of Guben. N. lat. 51° 32'.

E. long. 14° 25'.—Also, a town of Saxony, at the source of the Spree; 28 miles E. of Dresden.

SPREMONT, a town of France, in the department of the Ourte, seated on a brook which runs into the Ourte, and together with a small country, called the "Ban of Spremont," insuladed within the bishopric of Liege; 13 miles S.W. of Liege.

SPRENDLINGEN, a town of France, in the department of the Rhine and Moselle; 8 miles E. of Creutznach.

SPRENGELIA, in *Botany*, received that name from the writer of this article, in honour of Mr. Christian Conrad Sprengel, master of a grammar-school at Spandow, in Brandenburg, who published at Berlin, in 1793, a most ingenious work, on the manner in which insects promote the impregnation of plants. This fact is illustrated by several hundred particular examples, accompanied with figures of each. Dr. Curtius Sprengel, now Professor of Botany at Halle, may also claim his share of botanical commemoration in the above name. His *Prodromus* of a work on the arrangement of Umbelliferous Plants, published in 1813, to say nothing of his letters on Cryptogamic Vegetables, and his edition of the *Philosophia Botanica* of Linnæus, may well entitle him to such distinction.—Sm. in the Stockholm Transactions for 1794, 260. t. 8. Tracts relating to Nat. Hist. 269. Willd. Sp. Pl. v. 1. 833. Ait. Hort. Kew. v. 1. 320. Brown Prodr. Nov. Holl. v. 1. 554. (Poiretia; Cavan. Ic. v. 4. 24.)—Class and order, *Pentandria Monogynia*. Nat. Ord. *Ericæ*, Juss. *Epacridæ*, Brown.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, chaffy, coloured, in five deep, equal, lanceolate segments, erect after flowering, permanent. *Cor.* of one petal, wheel-shaped, beardless, in five very deep equal segments, the length of the calyx. Nectary none. *Stam.* Filaments five, inserted into the receptacle, linear, flat, smooth, shorter than the corolla; anthers vertical, oblong, parallel, more or less combined, of one cell. *Pistl.* Germen superior, roundish, depressed, with five furrows; style simple, cylindrical, about as long as the stamens; stigma obtuse. *Peric.* Capsule somewhat cylindrical, obtuse, with five furrows, of five valves and five cells, the partitions longitudinal, from the centre of each valve. *Seeds* numerous, roundish, minute, inserted into the angles of the central column, which is shorter than the valves.

Ess. Ch. Calyx in five deep segments, permanent, coloured. Corolla wheel-shaped, in five deep segments, beardless. Stamens inserted into the receptacle. Anthers converging or combined. Nectary none. Capsule of five valves and five cells, the partitions from the middle of each valve.

1. *S. incarnata*. Flesh-coloured Sprengelia. Sm. Tracts, 272. t. 2. Willd. n. 1. Ait. n. 1. Br. n. 1. Andr. Repos. t. 2. (Poiretia cucullata; Cavan. Ic. t. 343. Lamarek Dict. v. 5. 449.)—Anthers combined, hairy. Calyx entirely coloured. Points of the leaves elongated.—Native of Port Jackson, New South Wales; found also by Mr. Brown in Van Diemen's island, and on the south coast of New Holland. Messrs. Lee and Kennedy raised the plant in 1793, and in their greenhouses it still flourishes, flowering from April to June. This is a pretty and singular shrub, about two feet high, rigid and much branched, leafy, ever-green, very smooth; the branches round. Leaves alternate, sheathing, sometimes imbricated in three ranks, recurved, lanceolate, acute, concave, entire, very smooth, rather glaucous, without rib or veins, tawny when faded, and finally loosened at their base, so as to turn round on the branch. *Stipulas* none. *Flowers* terminating the numerous, short, crowded, lateral branches, clothed with smaller leaves,

leaves, and making a very pretty appearance. We do not find that they have any scent. *Calyx* rose-coloured, half an inch in diameter. *Corolla* and *filaments* flesh-coloured. The name of *Poiretia*, given by Cavanilles, was not published till three years after our *Sprengelia*.

2. *S. montana*. Mountain *Sprengelia*. Br. n. 2.—“Anthers unconnected, beardless. *Calyx* partly coloured. Points of the leaves short.”—Gathered by Mr. Brown in Van Diemen’s island. We have seen no specimens of this species.

Mr. Brown’s *PONCELETIA* (see that article), as well as his *Anderfonia*, Prodr. Nov. Holl. v. 1. 553. Ait. Hort. Kew. v. 1. 321, seems very nearly related to the present genus, both in aspect and character.

SPRETZA, in *Geography*, a river of Bosnia, which runs into the Bosna.

SPREWIL, a town of North Carolina, on the south coast of Albemarle sound. N. lat. 35° 56'. W. long. 76° 39'.

SPRIG, a small eye-bolt, ragged at the point.

SPRIG is also a small branch or spray. It likewise signifies a brad.

SPRIGE, in *Geography*, a township of Ohio, in the county of Adams, containing 1664 inhabitants.

SPRIGNO. See *SPIGNO*.

SPRING, *FONS*, in *Natural History*, a fountain or source of water, rising out of the ground.

The origin of springs or fountains has been much controverted among our late naturalists. Messrs. Mariotte and Perrault ascribe them to rain, to which others have added dew; their doctrine is, that the rain-water penetrates the earth till such time as it meets a clayey soil, or stratum; which proving a sufficient solid bottom to sustain and stop its descent, it glides along it that way to which the earth declines, till meeting with a place, or aperture, on the surface, through which it may escape, it forms the head of a river.

Now, that the rain is sufficient for this effect, appears hence; that, upon calculating the quantity of rain and snow which falls yearly on the tract of ground, that is to furnish, for instance, the water of the Seine, it is found that river does not take up above one-sixth part of it.

Springs ordinarily arise at the bottom of mountains: the reason, they say, is, that mountains collect the most waters, and give them the greatest descent the same way: and that if we sometimes see springs on high grounds, and even on the tops of mountains, they must be brought from other remoter places considerably higher, along beds of clay, or clayey ground, as in their natural channels. If, then, there happen to be a valley between a mountain on whose top is a spring, and the mountain that is to furnish it with water, the spring must be looked on as water conducted from a reservoir of a certain height through a subterraneous channel, to make a jet of an equal or somewhat less height.

This theory M. de la Hire (Parisian Mem. for 1703) has taken under examination, in its most essential article, and that where the authors seem to have been the least distrustful. He has endeavoured to find by experiment, whether rain or snow-water could penetrate the earth as low as the clayey stratum: with this view he procured a leaden vessel eight feet deep, having a pipe at the bottom: this he buried in the earth, and filled with soil of sand and loam, exposing the surface to receive all the rain that fell. After fifteen years’ trial, he found that no water had run through the pipe at the bottom. Again, he took another vessel, eight inches deep, which he filled with earth, and exposed in like

manner. No rain penetrated so as to run out at the bottom from June to February; but after that time it yielded a quantity after most rains. Another vessel of twice the depth, or sixteen inches, gave a result much like that of eight inches. When herbs were planted in this last-mentioned vessel, he found that as soon as ever any of these came up, and were grown to any bulk, so far was the rain that fell from being able to gather itself at the depth of sixteen inches, that it was not sufficient even to feed the plants, but there was a necessity for watering them.

With respect to the first-mentioned fact, says Mr. Dalton, (Manchester Memoirs, vol. v.) we need not wonder that no water penetrated through eight feet of earth at Paris, where the annual rain is but 20 inches, when only eight or nine inches penetrated through three feet of earth here, where the rain is 33 or 34 inches annually. But it does not follow, that rain may not descend down declivities of the ground into vallies or lower parts, at Paris as well as here, and being accumulated, may penetrate into the earth to a considerable depth, especially if it meet with channels or chafms of any kind, or declining strata of earth, that are impenetrable by water. Paris, Mr. Dalton believes, however, is not very liberally supplied with springs, as might be expected. As to the experiment upon vegetation, it only proves that the rain in spring and summer is sometimes not sufficient to support vegetable life, a fact which may readily be granted; but then in his experiment the plants were precluded from a supply of moisture from the earth beneath the vessel, which is a reserve of the utmost consequence in dry seasons.

This circumstance of water ascending again in the earth, on whatever principle it is effected, cannot be denied. There were four inches and three-quarters of rain here in July last, none of which passed through the earth in the evaporating vessel; this earth, however, at the end of the month, was far from that degree of dryness which is unfit for the support of vegetation. During the first four days of August there fell about three inches of rain, and only half an inch penetrated through the earth in the evaporating vessel. Consequently three feet in depth of earth that was moderately moist imbibed nearly three inches of rain, before it was saturated; whence we may conclude, that three inches nearly had ascended and been evaporated. This evidently shews, that earth is capable of holding a very great proportion of water, that in summer the water ascends to supply the exigencies at the surface, and that earth far under the point of saturation with moisture is still fit to support vegetation.

This observation suggested the following question—How much water is there in a given depth of earth, when the soil is at the point of saturation, or in that state, when it begins to yield water from the lower pipe of the evaporating gauge?

To determine this, Mr. Dalton took a quantity of garden soil, that had been soaked with rain a day before, and pressed it into a crucible; in this state he found its specific gravity to that of water, as five to three. It was then exposed to a moderate heat, till it appeared, as near as he could judge, of the same moisture as garden soil two inches deep in dry summer weather; afterwards it was exposed almost to a red heat, till it became a perfectly dry powder; in the former case it lost one-twelfth of its weight, and in the latter one-third. When it had lost one-sixth, it did not appear too dry to support vegetation. When it had lost two-ninths, it appeared like the top soil in summer. Hence it follows, that every foot of earth in depth, so saturated, contains seven inches of water, and that it may part with a quarter

SPRING.

a quarter of its water, or even a half, and not be too dry for supporting vegetation.

Clay, just dug out for the purpose of making bricks, was tried in the same manner. It gave the same specific gravity as the earth, and yielded not much less water.

These experiments and observations prove, that M. de la Hire's conclusions, drawn from the vegetation of plants in a given quantity of soil, precluded from any communication with the earth at large, are erroneous, or at least unwarranted; as it does not thence appear, that the evaporation for the whole year exceeds the rain in the year, whatever it may do for a month or two in summer.

The origin of springs may still, therefore, be attributed to rain, till some more decisive experiments appear to the contrary.

Upon the whole it should seem, that at the commencement of spring, the ground is nearly saturated with water for five or six feet in depth, as the rains and dews in autumn and winter far exceed the evaporation. There are then five or six inches of water at least to be raised up again to the surface in case of exigence in the spring and summer. If this happen to be so, then it is at the expence of springs; for we find the generality of springs become languid, or entirely cease to flow at the end of a long drought. As to the few springs that seem to be little affected by dry or wet seasons, they form exceptions, which it would not be difficult to account for. See EVAPORATION.

Dr. Halley refers the origin of springs merely to vapours raised by the heat of the sun, or of subterraneous fires, from the sea, lakes, rivers, &c.

Now, to shew that vapour is a sufficient fund to supply all our springs, rivers, &c. the same excellent author makes an estimate of the quantity of vapour raised from the Mediterranean sea, by the action of the sun: for the result of which, see VAPOUR.

Yet the quantity of water thus raised, great as it is, is only the remains of what is raised another way; *viz.* by the winds, which sometimes sweep the water off much faster than the sun takes it up.

To find, now, the quantity of water the Mediterranean receives, allow the most considerable rivers it receives, *viz.* the Iberus, Rhone, Tiber, Po, Danube, Neister, Borysthenes, Tanais, and the Nile, each to furnish ten times as much water as the Thames; not that any of them are in reality so great, but so to allow for the lesser rivulets; but the Thames is found, by calculation, to evacuate 20,300,000 tons of water daily. All the nine rivers above-mentioned, therefore, will only evacuate 1827 millions of tons in a day; which is little more than a third of what is raised in that time in vapour. The whole Mediterranean, according to calculation, is computed to contain 160 square degrees, yielding at least 5280 millions of tons. (Phil. Trans. N^o 189. or Abr. vol. ii. p. 110.) For a more correct estimate by Mr. Dalton, see RIVER.

The prodigious quantity of water remaining, Dr. Halley allows to rains, which fall again into the seas, and for the purposes of vegetation, &c. As to the manner in which this water is collected, so as to form reservoirs for the different kinds of springs, it seems to be this: the tops of mountains, in general, abound with cavities and subterraneous caverns, formed by nature to serve as reservoirs; and their pointed summits, which seem to pierce the clouds, stop those vapours which fluctuate in the atmosphere, and being condensed by them, they precipitate in water, and by their gravity easily penetrate through beds of sand and lighter earth, till they are stopped in their descent by more dense strata, as beds of clay, stone, &c., where they form

a basin or cavern, and work a passage horizontally, and issue out at the sides of the mountains. Many of these springs discharge water, which running down between the ridges of the hills, unite their streams, and form rivulets or brooks; and many of these uniting again on the plain, become a river.

After all that can be said in favour both of rain and vapour, it must be owned, they are both still encumbered with great difficulties; though by no means insuperable.

The perpetuity of divers springs, always yielding the same quantity of water, when the least rain or vapour is afforded as well as the greatest, is a strong objection to both. Dr. Derham mentions one in his own parish of Upminster, which he could never perceive by his eye to be diminished in the greatest droughts, even when all the ponds in the country, as well as an adjoining brook, had been dry for several months together; nor ever to be increased in the most rainy seasons, excepting perhaps for a few hours, or at most for a day, from sudden and violent rains. Had this spring its origin from rain or vapour, there would be found an increase and decrease of its water corresponding to those of its causes; as we actually find in such temporary springs as have undoubtedly their rise from rain and vapour: add to this, another considerable thing in this Upminster spring, and thousands of others; *viz.* that it breaks out of so inconsiderable an hillock, or eminence, as can have no more influence in the condensation of the vapours, or stopping the clouds, than the lower lands about it have. The very highest ground in the country he finds is not above a hundred and thirty-three yards above the level of the sea; and what is such an inconsiderable rise of land, to perennial condensation of vapours, fit to afford so considerable a spring? or the high lands of the whole country, to the maintaining all its fountains and rivulets?

Other naturalists, therefore, have had recourse to the sea, and derive the origin of springs immediately thence; but how the sea-water should be raised up to the surface of our earth, and even to the tops of the mountains, is a difficulty, in the solution of which they cannot agree. Some fancy a kind of hollow subterranean rocks to receive the watery vapours raised from channels communicating with the sea, by means of an internal fire, and to act the part of alembics, in freeing them from their saline particles, as well as condensing and converting them into water. This kind of subterranean laboratory, serving for the distillation of sea-water, was the invention of Descartes. (Princip. part iv. § 64.) Others, as M. de la Hire (Mém. de l'Acad. an. 1703), &c. set aside the necessity of alembics, and think it enough that there be large subterranean reservoirs of water at the height of the sea, whence the warmth of the bottom of the earth, or even the central fire (if there be such a thing), may raise vapours; which, pervading not only the intervals and fissures of the strata, but the bodies of the strata themselves, at length arrive near the surface; where, being condensed by the cold, they glide along on the first bed of clay they meet with, until an aperture in the ground lets them out. M. de la Hire adds, that the salts of stones and minerals may contribute to the detaining and fixing the vapours, and converting them into water. But we have a still more natural and easy way of exhibiting the rise of the sea-water up into mountains, &c. by putting a little heap of sand, ashes, a loaf of bread, or the like, into a basin of water; in which case the sand, &c. will represent the dry land, or an island; and the basin of water the sea about it. Here the water in the basin will rise to or near the top of the heap, in the same manner, and from the same principle, as the waters of the sea, lakes, &c. rise in the hills. The principle

principle of ascent in both is accordingly supposed to be the same with that of the ascent of liquids in capillary tubes, or between contiguous planes, or in a tube filled with ashes; all which are now generally accounted for from the doctrine of attraction. See RIVER.

Against this last theory, M. Perrault and others have urged several unanswerable objections. It supposes a variety of subterranean passages and caverns, communicating with the sea, and a complicated apparatus of alembics, heat and cold, &c. of the existence of which we have no sufficient proof. Besides, the water that is supposed to ascend from the depths of the sea, or from subterranean canals proceeding from it, through the porous parts of the earth, as it rises in capillary tubes, ascends to no great height, and in much too small a quantity, to furnish springs with water, as M. Perrault has sufficiently shewn. And though the sand and earth through which the water ascends may acquire some saline particles from it, they are nevertheless incapable of rendering it so fresh as the water of our fountains is generally found to be. Not to add, that in process of time, the saline particles of which the water is deprived, either by subterranean distillation or filtration, must clog and obstruct those canals and alembics by which it is supposed to be conveyed to our springs, and the sea must likewise gradually lose a considerable quantity of its salt.

In speaking of the situation of the earth, as connected with the formation of springs, Dr. Darwin has observed, that it consists of strata, many of which were formed originally beneath the sea. The mountains were afterwards forced up by subterraneous fires, as appears from the fissures in the rocks of which they consist, the quantity of volcanic productions all over the world, and the numerous remains of craters of volcanoes in mountainous countries. Hence it is contended, that the strata which compose the sides of mountains lie slanting downwards, and that one or two, or more, of the external strata not reaching to the summit when the mountain was raised up, the second or third stratum, or a still more inferior one, is there exposed to day; this may be well represented, it is said, by forcibly thrusting a blunt instrument through several sheets of paper, a bur will stand up with the lowermost sheet standing higher in the centre of it. On this uppermost stratum, which is colder as it is more elevated, the dews are condensed in large quantities, and sliding down, pass under the first or second or third stratum, which compose the sides of the hill; and either form a morass below, or a weeping rock, by oozing out in numerous places, or many of these less currents meeting together, burst out in a more copious rill.

But that, as the springs consist of the water which slides down between those inclined strata; it is evident that, in some eminences of ground they are only to be met with on one side of the mountain; and in other eminences of ground, on all sides of it. In searching for springs, therefore, attention should be given to the inclination of the strata of that part of the country, which may be often seen in marle-pits, gravel-pits, or in hollow lanes. But they may in general be found above any moist or morassy place, or valley; the moisture of which shews that springs exist in the strata on that side of the hill or mountain. And another observation for the purpose of detecting springs, may, it is said, be made on misty evenings; as those parts of the ground where the mist commences, are moister than those in their vicinity on the same level, and in consequence may generally, if they are not hollow basons, possess springs nearer the surface; for these moister parts of the ground, having evaporated more during the day, are become colder on their surfaces than the drier ground in their vicinity; and in misty evenings,

which are at the same time calm, the stationary air over these moist parts of the ground is also more loaded with the evaporated moisture; and on both these accounts, these moister situations are liable to shew a condensation of aerial vapour sooner than other places on the same level. And there may be other causes of springs in the nature of hilly situations, for as mountains are colder in proportion to their height, 1st, their being in a manner insulated or cut off from the common heat of the earth, which is always of 48° , and perpetually counteracts the effects of external cold beneath that degree, may be one cause. 2. From their surfaces being larger in proportion to their solid contents, and hence their heat more expeditiously carried away by the ever moving atmosphere. 3. The increasing rarity of the air as the mountain rises. All those bodies which conduct electricity well or ill, conduct the matter of heat likewise well or ill. Atmospheric air is a bad conductor of electricity, and thence confines it on the body where it is accumulated; but when it is made very rare, as in the exhausted receiver, the electric aura passes away immediately to any distance. The same circumstance probably happens in respect to heat, which is thus kept by the denser air on the plains from escaping, but is dissipated on the hills, where the air is thinner. 4. As the currents of air rise up the sides of mountains, they become mechanically rarefied, the pressure of the incumbent column lessening as they ascend. Hence the expanding air absorbs heat from the mountains as it ascends. 5. There is another, and perhaps more powerful cause, it is suspected, which may occasion the greater cold on mountains, and in the higher parts of the atmosphere, and which has not yet been attended to; it is meant that the fluid matter of heat may probably gravitate round the earth, and form an atmosphere, which may diminish or become rarer, as it recedes from the earth's surface, in a greater proportion than the air diminishes. And the greater condensation of moisture on the summits of hills has another cause, which is the dashing of moving clouds against them; in misty days this is often seen to have great effects on plains, where an eminent tree, by obstructing the mist as it moves along, shall have a much greater quantity of moisture drop from its leaves, than falls at the same time on the ground in its vicinity. Hence it is concluded, as suggested above, that the evening mist commences sooner on them than in the valleys, but is seen earlier in the situations over the moister places, if they are on the same level with the drier ones, exactly as on the plains or valleys; and may therefore indicate the existence of springs, unless these moister places consist of hollow basons, containing water, which, if not attended to, may in all situations deceive the observer. And further observations for detecting springs may be made in rimy mornings; for as moist earth is a better conductor of heat than dry earth, the rime will sooner melt on those parts of the soil which are kept moist by springs under it than in other parts; as the common heat of the earth, which is 48° in this country, will sooner be conducted upwards in moist places to dissolve the rime on the surface. On this account the rime is frequently seen on frosty mornings, when the heat of the air is not much above 32° , to lie an hour longer on dry cakes of cow-dung, or on bridges, or planks of wood, than on the common moist ground, as the latter much better conducts the common heat of the earth to the incumbent rime which is in contact with it. But as the heat of the common springs in this country is 48° , where they exist, the rime is sooner dissolved than on the stagnant moisture of bogs or morasses. It is therefore concluded, that the common cold springs are thus formed on elevated grounds by the condensed vapours, and hence are stronger when the nights are cold, after hot days

days in spring, than even in the wet days of winter. For the warm atmosphere during the day has dissolved much more water than it can support in solution during the cold of the night, which is thus deposited in large quantities on the hills, and yet so gradually, as to soak in between the strata of them, rather than to slide off over the surfaces, like showers of rain. The common heat of the internal parts of the earth is ascertained by springs which arise from the strata of earth too deep to be affected by the heat of the summer, or the frosts of winter. Those in this country, as has been seen, are of 48° of heat, those about Philadelphia were said by Dr. Franklin to be 52°. Whether this variation is to be accounted for by the difference of the sun's heat in that country, according to the ingenious theory of Mr. Kirwan, or to the vicinity of subterranean fires, is not yet, it is thought, decided. And in the winter months, the rise of springs may be detected in moist ditches by the presence of aquatic plants, as of the water-cress, water-parsnip, brook-lime, &c.; as in those ditches which become dry in summer these plants do not exist; and when those ditches with springs in them are nearly dry, it may be discovered which way the current has formerly descended, by the direction of the points of the leaves of aquatic plants, as certainly as by a level; an observation which was learnt from Mr. Brindley, the great canal conductor of Staffordshire.

The proper application of these principles may lead to many useful conclusions, both in respect to agriculture and rural economy, and is a sort of knowledge which those engaged in the providing of water for wells or pits should be well acquainted with. See DRAINING, WATER, and WELL.

For the method of preventing or remedying the injury done to land by springs, &c. see SPRING-Draining.

SPRINGS, *Different Sorts of.* Springs are either such as run continually, called *perennial*; or such as run only for a time, and at certain seasons of the year, and therefore called *temporary* springs. Others, again, are called *intermitting* springs, because they flow and then stop, and flow and stop again; and *reciprocating* springs, whose waters rise and fall, or flow and ebb, by regular intervals, which are also called "ebbing and flowing wells." In order to account for these differences in springs, let A B C D E (Plate XV. *Hydraulics*, fig. 7.) represent the declivity of a hill, along which the rain descends; passing through the fissures or channels B F, C G, D H, and L K, into the cavity or reservoir F G H K M I; in this cavity let there be a narrow drain or duct K E, which discharges the water at E. As the capacity of the reservoir is supposed to be large in proportion to that of the drain, it will furnish a constant supply of water to the spring at E. But if the reservoir F G H K M I be small, and the drain large, the water contained in the former, unless it is supplied by rain, will be wholly discharged by the latter, and the spring will become dry; and so it will continue, even though it rains, till the water has had time to penetrate through the earth, or to pass through the channels into the reservoir; and the time necessary for furnishing a new supply to the drain K E, will depend on the size of the fissure, the nature of the soil, and the depth of the cavity with which it communicates. Hence it may happen, that the spring at E may remain dry for a considerable time, and even whilst it rains; but when the water has found its way into the cavity of the hill, the spring will begin to run. Springs of this kind, it is evident, may be dry in wet weather, especially if the duct K E is not exactly level with the bottom of the cavity in the hill, and discharge water in dry weather; and the intermission of the spring may continue for several days. But if we suppose

X O P to represent another cavity, supplied with water by the channel N O, as well as by fissures and clefts in the rock, and by the draining of the adjacent earth; and another channel S T V, communicating with the bottom of it at S, ascending to T, and terminating on the surface at V, in the form of a *siphon* (which see); this disposition of the internal cavities of the earth, which we may reasonably suppose that nature has formed in a variety of places, will serve to explain the principle of reciprocating springs. For it is plain that the cavity X O P must be supplied with water to the height Q P T, before it can pass over the bend of the channel at T, and then it will flow through the longer leg of the siphon T V, and be discharged at the end V, which is lower than S. Now if the channel S T V be considerably larger than N O, by which the water is principally conveyed into the reservoir X O P, the reservoir will be emptied of its water by the siphon; and when the water descends below its orifice S, the air will drive the remaining water out of the crooked channel S T V, and the spring will cease to flow. But in time the water in the reservoir will again rise to the height Q P T, and be discharged at V, as before. It is easy to conceive, that the diameters of the channels N O and S T V may be so proportioned to one another, as to afford an intermission and renewal of the spring V at regular intervals. Thus, if N O communicates with a well supplied by the tide, during the time of flow, the quantity of water conveyed by it into the cavity X O P, may be sufficient to fill it up to Q P T; and S T V may be of such a size as to empty it, during the time of ebb. It is easy to apply this reasoning to more complicated cases, where several reservoirs and siphons, communicating with each other, may supply springs, with circumstances of greater variety. See Muschenbroeck's *Introductio ad Phil. Nat.* tom. ii. p. 1010. *Desag. Ex. Phil.* vol. ii. p. 173, &c.

We shall here observe, that Desaguliers calls those *reciprocating* springs which flow constantly, but with a stream subject to increase and decrease; and thus he distinguishes them from *intermitting* springs, which flow or stop alternately.

It is said, that in the diocese of Paderborn, in Westphalia, there is a spring which disappears twice in twenty-four hours, and always returns at the end of six hours with a great noise, and with so much force, as to turn three mills not far from its source. It is called the *bolder-born*, or *boiliterous* spring. *Phil. Transf.* N° 7. p. 127.

There are many springs of an extraordinary nature in our own country, which it is needless to recite, as they are explicable by the general principles already illustrated.

Springs are farther divided into *oozing* or *weeping* springs, where the water gently trickles through the pores of the land; *pipe* springs, where they appear in a single rill; and *wall* springs, where the water issues, as it were, through the joints of a wall. But besides these, springs have many other local names, which serve to distinguish them in their particular situations, where they break out in grounds. See SPRING-Draining.

SPRINGS, *Burning, or Boiling.* The burning spring near Grenoble, in Dauphiné, is famous. St. Augustine speaks of it as extinguishing lamps which are lighted, and lighting those which are extinct. But it is now cold, like others; only near it is a spot of ground, which still emits a light flame; over which some imagine it might anciently have passed. *August. de Civ. Dei*, lib. xxi. cap. 7, and 11. *Mem. Acad. Inscript.* tom. ix. p. 565. *Mem. Acad. Scien.* an. 1699, p. 26.

At Boseley, near Wenlock, in Shropshire, there is a famous

mous boiling well, which was discovered in June 1711, by an uncommon noise in the night, so great, that it awakened several people, who being desirous to find what it was owing to, at length found a boggy place under a little hill, not far from the Severn; and perceiving a great shaking of the earth, and a little boiling up of water through the grafs, they took a spade, and digging up some part of the earth, the water flew to a great height, and was set on fire by a candle. This water was for some time afterwards constantly found to take fire, and burn like spirit of wine; and after it was set on fire, it would boil the water in a vessel sooner than any artificial fire, and yet the spring itself was as cold as any whatever. Phil. Transf. No. 334.

This well was at length lost for many years, and not recovered till May, 1746, when by a rumbling noise under ground, like to what the former well made, it was hit upon again, though in a lower situation, and thirty yards nearer the river.

The well is four or five feet deep, and six or seven wide; within that is another less hole of like depth, dug in the clay, in the bottom of which is placed a cylindric earthen vessel, of about four or five inches diameter at the mouth, having the bottom taken off, and the sides well fixed in the clay, rammed close about it. Within the pot is a brown water, thick as puddle, continually forced up by a violent motion, beyond that of boiling water, and a rumbling hollow noise, rising and falling by fits five or six inches. It may be fired by a candle at a quarter of a yard distance; and it darts and flashes in a violent manner, about half a yard high. It has been left burning forty-eight hours, without any sensible diminution. It may be extinguished by putting a wet mop upon it, which must be kept there a small time. On the removal of the mop there succeeds a sulphureous smoke, lasting about a minute, and yet the water is very cold to the touch. Phil. Transf. No. 482, sect. 6.

SPRING, *Lancarim*. See LANCARIM.

SPRINGS, *Medicinal*. See WATER.

SPRINGS, *Artificial*, those kinds of springs, or collections of water, which are made by art in different views and intentions, by the farmer and land proprietor.

The methods of proceeding in these sorts of undertakings may be those of making a sufficient number of under-drain springs for the purpose of the above kind, in different directions, so as that they may unite in one, at or near their terminations in the wells or cisterns, as, in these ways, the water may be drawn from a much larger space of ground than would otherwise be the case, and, of course, better supplies of water be afforded.

Country-houses and residences may sometimes be supplied with good water in somewhat this way, where there is either a deficiency in the quantity or quality of that which is provided. A very distinguished proprietor in the county of Berks, E. L. Loveden, esq. of Buscot Park, had recourse, it is said, to the following very ingenious and successful contrivance, in order to accomplish this purpose, which deserves to be particularly noticed, as it may be applicable to many other situations, where the scarcity of water, or of such as is good, is felt. It is stated in the Agricultural Report of the above district, that, the seat of this proprietor standing near the very brow of the eminence on which it is built, there was only a superficies of about an acre and a half of grass-land in front, from which there was not the least descent. A semicircular drain with a mole-plough, scarcely perceptible on walking over the ground, in the line of the greatest elevation, was made to communicate with two small iron grates on the side of the gravel-drive up to the principal front. All the water which falls on this drive passes to one

or other of those grates, between which there is an underground drain, with a very moderate fall to that which is the most westerly, where a channel commences which is capable of receiving all the water within the compass of the semicircular drain, and which passing through proper strainers, is conveyed to a large sunk reservoir, in a court to the westward of the mansion; and a pump being placed there, the family is supplied, it is said, with a pure soft water, no less salutary than useful for every domestic purpose.

Springs of the above artificial kind may likewise be applicable in many other cases, where there is a want of water for particular uses.

SPRINGS, *Land*, such of the more superficial kind as rise and exist in situations where the collecting surface of the water, together with the containing stratum, are of a rather small and confined extent. They are often met with about the bases of hilly lands, on slopes, at the feet of the little risings in valley tracts, in their variously mixed banks, as well as in many other situations and circumstances of land. The term is also sometimes applied to the drains which are made by art for the procuring of water for different purposes.

They are always such as are of the more superficial kind. The writer of the work on "Landed Property" considers these springs as partial effects, partaking of the nature of cold, or of weak lands, according to the quality of the soil that covers them. They may, it is said, be considered as the most common disease of land where water is concerned.

It is supposed that the causes of these sorts of springs are mostly of a topical nature, the disease being commonly produced by rain-water falling on an absorbent soil which has a broken sub-stratum. A broad, flat-topped swell of sandy or gravelly loam, beset with plots or masses of clay, is, it is thought, singularly productive of this sort of watery lands. The means of remedying the injurious wetness arising from these kinds of springs, are shewn in speaking of spring-draining. See SPRING-Draining.

SPRING-Drain, that sort of drain or channel which is prepared and constructed in land for the purpose of taking away such kinds of over-wetness in it, as is caused by internal or other springs. These drains are made in many different methods, according to the nature and circumstances of the grounds, and the degrees of the wetness which are present in them; but, for the most part, in a deeper and more substantial manner than in the other modes of forming drains.

Drains of this sort are constructed of many different kinds of materials, but mostly of those which are of the more solid and durable descriptions, such as the common brick, bricks made in different forms and shapes for the purpose, pipes made in different ways, flat stones of the free-stone and other kinds, common stones laid in different modes, and some other similar substances. Where common bricks are employed, they are often built in a firm manner on the sides and arched over the tops, but in other cases laid lengthwise over each other to the necessary height, and then covered over with flat stones, and the earth filled in upon them. They have also other modes of construction, which are sometimes much less expensive, according to the nature of the drainage, as will be more fully seen and explained in speaking of surface-drains. But where bricks made for the purpose are used in these cases, other methods are followed. There are many different forms of bricks contrived in this intention; one of which is so constructed, as to form, when laid, a small neat arched drain four inches in diameter, and is principally made use of where only small drains are necessary, as in the conveying of the water of
springs

SPRING.

springs to houses and other buildings, &c. A second sort is made of three pieces, so as to constitute a square drain six inches in width and height; and a third kind is formed with a circular opening six inches in diameter, having long square openings in the top part, and light parts two inches in breadth, to rest upon, on the sides. It was invented by Mr. Couchman, of Bosworth Temple, in the county of Warwick. The two last sorts are well suited for forming large drains, but more especially the latter. In stiff soils, they are for the most part best when laid singly, without any common bricks or tiles being placed underneath them; but in light sandy lands, it is mostly better to lay common bricks, or strong tiles, under their sides, in order to prevent their sinking down into the soil too much. See *SPRING-Draining*.

Another sort of bricks that may be employed in this way, it is supposed, with still greater advantage than the above, has been invented by John Ashworth of Turton, near Bolton, in the county of Lancashire. These are contrived in different forms and shapes, so as to be laid in different manners, and form different sorts of openings. When they are placed in such a manner as to constitute a sort of inclosed triangular opening for the discharge of the water from the land, eighty-four bricks are required to every eight yards; while with common bricks, one hundred and ninety are necessary. There is consequently a saving, by this means, of one hundred and six bricks in every eight yards of draining that is performed. By another form of these bricks, laid so as to slant against each other, without any thing under them, fifty-five bricks are only necessary for draining eight yards in length; and, of course, one hundred and thirty-seven bricks are saved in that extent. In another form in which these bricks are laid, which represents a sort of inclosed diamond-formed opening, one hundred and ten bricks of this kind are taken to complete the same length of drain, by which eighty-two bricks are saved. This form is, however, only necessary where the quantities of water to be carried off, or taken away, are very large. In a further different form and manner of laying these bricks, the same number are made use of as in the first case, and the saving of common bricks is in the same proportion. A farther still different form and manner of laying these bricks, employs them in the same proportion as in the third case, and saves common bricks in the same extent. This is particularly useful in the drainage of boggy, swampy, soft lands, and where quicksands are present. There is yet another form and manner of laying these bricks, which saves common bricks in the same manner as in the second of the above cases. And there is, lastly, a still different form and manner of laying these bricks, which takes them in the same quantities as in the third and fifth cases above, and consequently saves common bricks in the same proportion as they do. See *SPRING-Draining Bricks*.

It is not improbable but that bricks for this purpose may have been invented by other persons, in different other districts, which may answer well for forming spring-drains in different cases. See *SURFACE-Drain*, and *SUBSOIL Brick-Drain*.

Drains formed of these materials, though they are commonly very effectual for the purpose, are in general attended with considerable expence.

Large pipes formed of burnt clay, and some other sorts of materials, are not unfrequently employed in the making of drains of this nature, as well as in some cases for those of the surface kind.

Where stones are made use of in constructing drains, for the purpose of carrying off the water of springs, there are

several different modes of laying them. They are sometimes built up on the sides, to the necessary heights and widths, by the smaller stones, and then covered over the tops, and connected by the large flat ones of the freestone, limestone, or other similar kinds: at other times, the flat stones, whether of the freestone, limestone, or other sorts, are set up edgeways in the bottoms of the drains, in a kind of triangular manner, or, which is better, in somewhat the form of the reverted letter A, the latter being laid over on the tops with broad flat stones. These constitute excellent cheap drains.

There are also several other matters of this nature, as those of the flaggy and slaty kinds, which may be used for this purpose, with equal advantage in different situations. See *SURFACE-Drain*.

It has been suggested, that in constructing main drains of this sort for carrying off and discharging the water of springs, besides the particular consideration of the nature of the soils through which they are to be cut and formed, which is constantly to regulate the whole of the future operations, processes, and works about them, where they are of a loose gravelly quality, or of the nature of a quick or running sand, the round or barrel form of drain, when turned with either common bricks or stones, the *lower* half being laid in mortar, and the *upper* half dry, may probably be the most effectual as well as the most durable of any that can be had recourse to, in such cases. In most instances, also, of drains for carrying away wetnesses of this kind, the outlets of them, where the water is discharged, should be well secured in some way or other, in order to prevent any injury that might be sustained by the force of the passing current of the water out of them.

As the common openings of the foughs or passages in these drains are mostly about six inches square, a piece of wood of that size, and about one yard in length, is often found very useful for laying in the bottoms of the drains, while forming, for building the stones or other materials on each of the sides of it, and which is capable of being drawn or shifted forward, as the workman proceeds in completing the foughs or drains.

The different tools used in forming and cutting drains are described under their proper heads.

The making of drains of this nature, in some districts and places is termed *foughing*, especially when they are formed with some sort of hard materials, such as bricks, stones, or other similar substances, and is a method of spring-draining which is very commonly had recourse to by the drainer. See *SOUGH* and *SPRING-Draining*.

SPRING-Draining, the removing of that sort of wetness in land, which is caused by, or which arises from, springs, in its internal or other parts, in the manner already explained under the article *DRAINING of Land*.

Its practice principally depends upon the discovery of the main springs in the different cases, upon the proper taking of their levels, and upon making use of such means as are capable of drawing off the water in particular instances, without the expence of too much cutting; as, without finding out the *main* spring, or cause of the mischief, nothing effectual can, it is said, be done; or without taking the exact level of it, and ascertaining the *subterraneous* bearings which it may have; as where the drains, in such cases, are cut even a very small distance beyond the lines of the springs, the water which issues from them can never be reached; whereas by exactly ascertaining those lines, by the practice of levelling, the springs can be cut off in an effectual manner, and the land be rendered dry in the least expensive and most eligible method. The superabundant

wetness of the land, where necessary, may be taken away, where the depth of the drains do not reach it, by making use of implements of the auger kind, so as to bore down, and tap or let off the water of the springs which lie still lower.

It is constantly necessary in this, as well as other kinds of draining, to pay great attention to the direction or mode of conducting the drains, and likewise to the application of the tools which are employed for tapping or drawing off the springs. It is perhaps principally in the superiority of management in these respects, that the excellence of Mr. Elkington as a drainer of land consists. But though the mode of tapping springs by means of the auger, and letting off the water from the bottom parts of the drains, without the trouble and expence of more cutting and digging, was unquestionably brought to practical perfection by this able drainer, its use for other similar purposes had long been known and experienced; as it has been asserted, that in attempting to discover mines by means of this tool, springs have been tapped, and the adjoining wet grounds, in consequence, drained or laid dry, either by letting the water down into a porous substratum below, or giving it a vent and exit at the surface. The same tool has also been employed in bringing water into wells, by boring with it in the bottoms of them, to save the expence of more digging. This is supposed to be the case more especially in Italy, where it is probable that the practice is of great antiquity, as Buffon has stated in his Natural History, that in and about the city of Modena, whatever part is dug, when the depth of sixty-three feet is reached, and five feet deeper bored with this tool, the water springs up with such force, that the well is filled in a very short space of time. It is likewise noticed, that, in these cases, the tool often bores through large trunks of trees, &c. which give great trouble to the workmen. This is consequently a tool which is not only well calculated for the purposes of spring-draining, in many instances, but for a great variety of different other rural uses and applications.

The porous rocky chalks are excellent conductors of water, it has been observed, where they have only a thin covering of an absorbent loamy material, as they imbibe, after the surface-soil has been saturated, every particle of water that may come upon them in the form of rain or otherwise. This is seen to be the case in many hilly situations formed chiefly of such matters, in the south-west parts of the kingdom, as in the counties of Wilts and Dorset. The water which is absorbed and taken up by so porous a substance as chalk, it is said, soon escapes the power of evaporation, and continues to descend, in the manner of that which passes through a filtering-stone, until it meet with an impervious or non-conducting stratum or layer, upon which it collects; and if this surface, on which it is collected, should lie above the level of the sea, or other collection of water, it forces its way out, in the manner of a spring, or more copious fountain; not always in one constant stream, but often periodically: the springs of chalk-hills differing, in this respect, from those of the more open conducting kinds; which is a fact, it is thought, that is entitled to be more fully and philosophically investigated. The action or operation of the waters of chalk-hills, it is suggested, is most clearly seen on the sea-coasts, where the bases of the chalk-cliffs rest upon an impervious or non-conducting stratum or bed, which being softened and worn away by the impression of the waters collected upon it, the cliffs are undermined, and the faces of them thrown down. Where the base of the chalk dips beneath the surface of the sea in low tides, the whole collection of water regains its "native home," it is said, unseen. And it is not doubted but that

much rain-water, passing through other strata, finds its way to the sea in a somewhat similar manner.

Rocks of the open kind, it is supposed, when they are examined as conductors of subterraneous water, will be found to have various effects in producing the necessity of this sort of draining, according as there may be a difference in their natural properties. Sand-rock, where it is present, always acts, in the manner of chalk and loose sand, as a filter, letting the water freely through it. There are many different parts of the kingdom in which it is found in considerable quantity and extent, the surface-soil being mostly dry in quality. Where the rock is of the nature of slate, from being of an argillaceous or clayey quality, it is often in a high degree impermeable to water; but as it in general abounds with cracks, fissures, and still finer crevices, especially near the surface, water readily finds its way into it, and either filtrates or percolates slowly through it, or finds a vent and exit in the clefts or separations of the masses; and, collecting in such parts, forces its way to the surface, as a spring; or continues to descend, until it meet with a more compact stratum, which dips towards the face of some hill or shelving ground, where, reaching the surface or outer limits of the rock, it either forces its way through the soil, and feeds a fountain, or, if the quantity of water is too small, or the thickness and texture of the soil are too powerful to permit it to escape in a body, spreads itself beneath the surface materials or thicker covering, and produces watery land. A shelf of slate-rock, under these circumstances, operates, it is believed, as a stratum of sand or gravel. Rocks of this nature are common to many different parts of the country, as to the counties of Devon, Cumberland, and Westmoreland, to Wales, and the western Highlands of Scotland; being, it is imagined, peculiar to the more western parts of the island.

Limestone rocks, which are most various in texture and arrangement of parts, are met with in many places as a substratum of soils. The soft and granulous kind, of which the Cotswold hills may be said to be composed, as well as those which arise in the environs of the city of Bath, and which are found in some places in Yorkshire, Northamptonshire, and probably in some other parts of the kingdom, is of a porous absorbent texture; water acting upon it as upon chalk. But the more ordinary sort of limestone, which may be said to be met with in almost every department of the kingdom, is of a more close texture. It is, however, commonly either divided and parted out into large blocks, or broken into fragments, though sometimes found distributed in continuous masses. Still more frequently, the blocks seem as if they had been thrown together in a fortuitous manner into their present situations, being separated by irregular interspaces, either filled with earth, or other fossil substances, or forming open fissures, cracks, and chasms of different widths; and, in a few known instances, form caves or openings of extraordinary dimensions. This class of limestone rocks may, it is supposed, without risk, be considered as the most free and extensive conductor of internal waters of any in this country. There are other kinds of this sort of rocky substrata, which have directly the contrary quality and effect in respect to the distribution of water in soils.

The next sort of material, which displays the most simple explanation of the effects which are produced by water falling or coming upon land, is that of sand, and especially where the lands are of the deep sandy kind, such as the county of Norfolk is chiefly composed of; sand, it is remarked, being of a more open and porous nature than chalk, and the hills formed by it, or the more depressed masses of it,

it, being in general of much less depth than those of that substance, the effect is more quickly produced. Presently after a glut of rain, the springs, in these cases, are said to fly out. Besides, there is another difference, which is more interesting, it is thought, to the present inquiry, between the effects produced by chalk and by sand, as conductors of rain or other water. Chalk, for the most part, throws it out from the sides or at the bases of the hills formed by it, in clear streams, producing no other effect on the surfaces of the lands than that of forming channels of conveyance for it to the rivulets or brooks, to which the particular cast of surface may incline them. The waters absorbed or drank up by chalk-hills seldom occasion, it is said, any thing of the nature of upland bog, unless when they rise in the area of a flat-based valley, or are impeded and obstructed therein, and by spreading and stagnating over its surface, encourage the growth and decay of aquatic plants. On the contrary, sand-hillocks are, it is said, singularly productive of this baneful disease of land; owing, in part, it is supposed, to a want of uniformity in their internal structures, as well as of an evenness of base, when compared with chalk hills, which generally rest on impervious strata of clay; and likewise owing to the openness of the texture of the sandy material, which suffers the contained waters to spread out and distend themselves freely in every direction.

Gravel is more porous, or conducts water still more freely, than sand; and is mostly found in thin strata or veins, but sometimes in detached masses, though very rarely in extended hills. In some situations it is free from the admixture of any sort of earthy matter. In this condition it conducts water as a pipe; or when embanked with impervious matters on every side, contains it as a cistern. When a stratum or layer of subterranean gravel, or any other free conductor, is supplied with, or has descending waters coming upon it, it either conducts them to the surface, leads them to a fountain, or, when the surface is too strongly guarded to allow of their escape, stores them up, and confines them in quantity beneath the soil. Where the gravel is partially deposited in veins, and the covering is thin, and of an absorbent or porous quality, the water, wherever it approaches the surface, fills every pore of the soil, and though unable to break its way out in a stream, as a strong spring, occasionally trickles and percolates through it; thus encouraging the growth of supraquatic plants; which, being too gross and unpalatable for pasturing stock, fall where they have grown, and, during a succession of ages, raise detached mounds of vegetable earth; partaking, like the moory basins of sand-hill vallies, of the nature of morafs.

If the containing stratum or bed be more generally and evenly spread beneath the soil, and where this is of an absorbent porous quality, and moreover so thin as to be easily permeable, as well as lying nearly level, a large extent of ground may, it is said, be rendered worthless,—may become a mere morafs, or extended bog. But if, under these circumstances, the land lies with much descent, the lower side only will be much affected. Further, if the soil or covering, though of an absorbent porous nature, be conjointly of a sufficient thickness and texture to prevent the contained waters from rising to the surface, an uniform breadth of cold weak land will be produced. Where the covering is not only thick, but impervious or non-absorbent, so as to prevent the depressed waters from rising to the roots or feeding fibres of field-plants, lands of a valuable quality are met with: even when in the state of perennial herbage, the finer grasses are, it is said, produced; but that, owing to the coolness which subjacent waters communicate to the soil, in the early spring, vegetation is more backward, and the

produce less than it would be, if the cause of the coolness were removed by this mode of draining. Land of this description is met with extensively, and in great abundance, on the slopes, and at the bases of the rising grounds, in almost every vale-district of the kingdom.

Pebbly matters, which are a common substratum of land, it is said, in the more mountainous parts of the country, act in a similar, but more complete manner; being a still more free conductor of subterranean waters than gravel.

The manner in which chalk conducts subterranean water to the sea, without injury to the surface of the land, is seen above; and open rock, sand, gravel, or any other porous or conducting material, either singly or in conjunction, have the same effect, when they form a free and continued connection between it and the surface of the open absorbent lands. But the same substructure, when situated at a distance from the shore, and cut off from all subterranean communication with the sea or other waters, by the intervention of impervious or repellent matters, produces widely different effects; and is capable of doing much mischief to the lower lands which more immediately invest it, as well as to those close around it. In these circumstances, the subsiding waters, unable to find a passage downwards, fill every fissure, crevice, and pore; continuing to collect, until the surface of the embodied waters reaches some friendly porous stratum, to conduct the overflow horizontally towards some open outlet; or until the collection has gained a sufficient ascendancy and weight to break its bounds, and force its way to the surface, or blend with the superficial waters. The bottom of a lake, or the channel of a deep-sunk river, first offers the means of relief, in many cases; and it is not unusual to see spring-waters curling at the surface of a deep river-pool. In many situations, it is supposed probable that rivers receive larger supplies from their own beds than is evident to the eye of common observation. Where the river-bed is shut against them, the impounded waters naturally continue to rise, until they reach an open stratum of the lands on its banks, and thus effect their escape. Where no such conducting stratum offers itself, deep cleft dingles and narrow dells, branching out of the rivered valley, or wider vale, may, it is said, be considered as the next places calculated for giving vent to rising waters: and here they are not uncommonly found boiling up through beds of sand or gravel, or the shattered fragments of rock; and by spreading, in a state of nature, over the base of the dell, give rise to moory grounds; or issuing from its banks, give birth to a more active stream. No deep sunk dell occurring, or any absorbent stratum of the vale lands being ready to receive the internal waters, or, having received them, being unable to give them vent, by reason of their being closed on their lower margin or border, the surface of the embodied waters necessarily continue to rise above the base of the hill, until, having reached a proper conductor, a spring or fountain is formed; or meeting with a descending substratum of absorbent or porous matter, it enters it with the effect of descending waters, and produces different sorts of wetness according to circumstances. On extensive continents, and even in the interior parts of this island, instances of a similar nature must necessarily, it is said, frequently occur.

It may be also noticed, that it must likewise not unfrequently happen, that waters which have been absorbed by the porous materials of high lands are checked in their descent, before they reach the base of the hill or mountain which has imbibed them; in the interior of which, it is more than probable, minor reservoirs are formed by rising waters, and there act in a similar manner to those which are
formed

formed at a greater depth. The perpetual springs which may be said to be every where issuing from the sides of hills, are strong evidences, it is thought, in favour of such a position. For what, it is asked, but an extended surface of embodied waters, could send forth these *constant*, and, in some instances, almost *uniform* streams? A lake, it is well known, thus regulates the stream which flows from it. But to produce this effect, it is not requisite, it is supposed, that the lake should be formed in the interior of a mountain. It matters not what the receptacle is, provided it be of sufficient extent, and its several parts, if anomalous, have a free communication with each other; whether it be a cave, an extended series of fissured rocks, or an extensive stratum of gravel, or any other freely conducting material, the surface of the water will be equally level, and equally capable of regulating the supplies received, so as to discharge an uniform or a moderated stream; as the wide naked waters do, which are seen to spread on the surface in mountain situations. A sudden shower does not sensibly affect, it is said, the overflow of a lake, nor does a heavy fall of rain cause a sudden flood; as it does where there is no such extent of surface to regulate the supply: nevertheless, after much rain, and still more after a long continued wet season, the overflow is increased, and the stream enlarged. And precisely so, it is said, are these sorts of springs or fountains affected.

The marles which abound in calcareous matter are mostly of an open, porous, and absorbent nature, and not unfrequently form the substrata of lands in different places, which may receive and hold water, in some cases so as to let it break out and produce springs on the surface, which are highly injurious to the soils. Some marles are, however, of an impervious and retentive quality.

There are also some sorts of materials which are highly impervious under some circumstances, but which become porous or open in others, as clay in certain states; this, however, has little to do with the nature of spring-draining. See *DRAINING of Land*.

In laying down the general principles and theory of draining land under its proper head, the manner in which the principal agents and causes which operate in the production of springs are capable of producing such effects in different circumstances, has been particularly explained, though the great internal springs which supply the intersecting rivers of countries have not been touched upon, as they have not yet been by any means sufficiently investigated or explored; and besides, they mostly lie at such great depths, as not to affect the surface, consequently have nothing, or very little, to do with the present inquiry.

Draining, on the principle of removing springs, not only produces extraordinary effects in the laying of the lands dry which are near to them; but in causing springs, in wells, wet grounds, and other places, at very considerable distances, to become dry, though they had no evident communication or connection.

Drainage of Boggy, Morassy, Swampy, and other wet Land, produced by Springs.—See *BOG* and *DRAINING of Land*, under which articles this subject is discussed as far as our limits will allow.

A pump has been lately contrived by Mr. Wakefield, the ingenious drainer of Trafford and other moorles in Lancashire, for ascertaining the lines of springs in this sort of draining, which is said to answer well. See *SPRING-Draining Pump*.

In many cases of this sort, it may be known, it is said, whether the channel of the water lie deep or not, by the appearance of the surface. Where the land is dry imme-

diately above the place where the water springs up, it is an evidence that the channel or reservoir lies deep, and that the water is forced up so as to issue in a perpendicular manner; but, on the contrary, where the land is wet for some distance above the principal outlet of the spring, it is a sure sign that the water is flowing in a channel near the surface, and that the *overflowings* of it cause this wetness. It will be a certain evidence of this, if there be only one spring in the wet ground; but if the internal strata do not lie horizontally, or regularly, and several springs appear, arising from water running in different channels, the land above the largest or principal spring may be wet, not from the *backing-up* of that spring, or its channel being near the surface, but by the breaking out of the lesser springs in their *descent*, the channel of the waters of which has thus found a vent and exit to and out of the surface, higher than that of the larger spring. It is in cases of this kind that draining is attended with most difficulty; and where all the cutting and other matters necessary cannot be so easily ascertained at first, until such time as what is absolutely requisite be executed, which will lead to the discovery of what further is wanted, and in what manner it should be accomplished, by exposing to view the subsoil, or under strata, in which the water flows. The making of *exploratory bores* with the auger, is, it is said, useful in this and all other difficult cases.

Where, in such cases as the above, there are different lines of drains cut one below another, from the highermost springs between the wet and dry land, not of such depth as to catch and intercept the water all the way down the slope, as formerly practised, however they may be filled with loose stones, though they may render the surface drier while they continue to run, they soon choke up, and bursting out in different parts, the land soon becomes equally, if not more wet, than it was before they were made, and so formed out. It is more difficult to drain this ground a second time, even in the proper manner; as the surface, by means of the former drains, being so much altered from its natural appearance, the true situation of the springs cannot so easily be hit upon, and the frequent bursts of the old drains increase the perplexity in no small degree. It frequently happens that the uppermost, where they are the *strongest* outlets, are the *main* springs, and those below only *leakages*; which implies, that some of the water from the main spring finds a passage through some opening in the *upper soil*, near the surface, and breaks out lower than the main spring, when it meets with resistance from any bed of clay: by cutting off the main spring, this of course becomes dry; therefore the same caution is necessary to ascertain this before proceeding to mark out the drain or drains in such cases, as from the *main spring only* the level must be taken. In irregular banks, where the ground, owing to the perpendicular situation or pressure of water behind, has *slipt*, or fallen down, the drain must be carried higher up the declivity than where the water has its apparent outlet, to the found ground that has undergone no change, and where the *real* spring will be intercepted; the water in the *slipt* sand below being only leakages from that above, but which is apt to deceive in cutting the upright trench, or that which is made from the outlet up to the cross one, along the line of the springs. When the main spring rises in a steep bank a considerable height above the level of the brook or place where the drain is to discharge itself, it is unnecessary to cut a deep trench, or to lay a covered drain, all the way from the brook up to it; for the descent being too rapid, and if deep cut by crossing veins of sand, that are always met with in such situations, the bricks or stones with which the *fough* or conduit of the drain is laid, would be undermined by

by the rapidity of the current, which would also carry down a great quantity of the loose sand; but it should be begun only so far down the bank, as, by *cutting in level*, the drain may be six or seven feet lower than the outlet of the spring, or whatever depth is necessary for drawing down the water to such a level as it may discharge itself without rising to the surface, or injuring the ground adjoining it. The remaining part of the cut, down to the brook, either in a straight or sloping direction, may be left open, and need not be deep, but guarded from the cattle, and from the plough when the field is in tillage. If covered, it need not be deeper than two feet; and there is no occasion for boring in any part of it.

When there may be any difficulty in ascertaining the exact line of the spring and that of the cross-drain, where it does not *appear* on the *surface*, or when there is no apparent outlet from whence to take the level, in bringing up the leading drain for carrying off the water, it can be then discovered when it crosses the proper line, and without cutting any farther up, the cross-drain must be carried on that level, so far to each side, along the *tail* or termination of the rock or sand containing the water, as the situation of the ground and other circumstances may require. And if, in cutting the cross-drain, the line marked out by the spirit-level should be found in some places to be below that of the springs; and if in boring along that line no water be found, then small cuts must be made, of the same depth, from the drain up to where the spring lies; for if the drain be cut *below* the line of the spring, all possibility of reaching it, even by the auger, is lost, as boring can have no effect where the substratum is clay, and where there is no *under* water; and if it be cut *above* the line of the spring, it will require deeper cutting and boring to reach it, as there, for the most part, the ground rises higher, and that part of the porous strata below the drain may contain as much water as may injure the ground, and which may easily pass under the bottom of the trench, between the auger-holes, and find vent below it. If the expanse of the valley or bog betwixt two banks be so narrow, that the stratum of rock or sand containing the springs, unites within reach of the auger below the clay, one trench up the middle, with auger-holes, will do the business, without any cross or branch-drains. Although the springs that injure ground in this situation break out of the banks all round nearly on the same level, yet the reservoir from whence they proceed may, it is said, be hit on in the middle of the valley, by boring through the superincumbent body of clay that forces the water to rise and ooze out along the upper edge of it, at its junction with the higher porous ground. The drain being cut in the hollow part of the ground, and the spring below bored into, it is evident that the depth of the drain being so much lower than the natural outlet of the springs, the pressure of water above that level, which is the bottom of the drain, will force that under the trench through the auger-holes; or even for some time, until the water subside, it might be made to rise higher than the level of its natural outlet. The consequence of this will be, it is further said, that the water of the spring having found, by means of the drain and boring, a new and easier channel, will soon abandon its former outlets, and cease to overflow the ground that formerly lay below it. Many remarkable instances of this sort of drainages are stated to have been performed by Mr. Elkington in different places, and particularly at Scarisbrick-Hall, near Ormskirk, in Lancashire.

However, bogs, or wet grounds of the same nature in similar situations, may, it is supposed, proceed from different causes, and, of course, require different sorts of treatment

in the removal of their wetnesses. In such cases, the first thing to be considered, in examining the ground, is, whether the springs proceed from one side only, from both sides, or lie in the middle of such bogs; as, according to the nature of these circumstances, the line or lines of the drain or drains must be directed. In order to properly ascertain this, it will be necessary to have recourse to the use of the spirit-level. If the bog should have a descent from one side to the other, although the wetness may appear all round, it will be evident that the water proceeds only from the higher side, but passing over and under the surface, part of it is absorbed by the dry ground along the lower side; from whence, if the level were not previously ascertained, it might be supposed also to proceed. In this case, one drain cut along the upper side will be sufficient to keep it dry. If the bog should have a descent from both sides to the middle, or be perfectly level, the springs may proceed from both sides; and will, consequently, require a drain on each, if they do not unite in the same stratum below the middle of the bog, and can be hit on by boring in one drain cut in the centre, as already shewn.

In case a bog of this nature between two hills is of great extent, it may be requisite to have three different drains; one on each side, and one in the middle; which last must be an open one, to receive the whole of the surface-water, as well as to cut off any springs that may arise in that part of the bog. In all cases of this nature, where there is any difficulty of discovering from whence the principal springs proceed, or what is the nature and inclination or disposition of the substrata, the application of the auger may be had recourse to for the purpose.

But in very wet swamps, or bogs of great extent, it is necessary to have other cuts than those that carry off the springs: for although the upper springs, which are the principal cause, be cut off, there may be veins of sand or gravel lower than those, out of which it is also necessary to extract the water. If the ground is to be divided into inclosures, the open ditches may be so directed as to hit on these lower collections of subjacent water, as well as to carry off any that might stagnate in the hollow parts of the surface. The next thing to be considered in this sort of draining is the conducting of the drain, after the levels have been taken, and the true line of it fixed; and whether it should be covered or open. If the land is to be inclosed, and as the line of the trench may serve as a proper division of the ground, it may be made an open cut, or sunk fence; if not, a covered drain: but it is first necessary to ascertain which, as the depth, width, and other circumstances, may be regulated accordingly. After finding the nearest outlet, where the water collected in the drain can be discharged, from that a trench must be brought up to the cross one that is to be carried along the line of the spring, allowing a small declivity of a few inches in every ten yards, for the water to run. In cutting the drain that is to carry off the spring, if, after passing the clay, there be a stratum of hard gravel betwixt that and the sand containing the water, it is preferable to lay the *fough* there, being a more solid foundation for it, and either to perforate the gravel with the *punch*, or open small pits through it with the spade; by means of which the water will flow up, and run as speedily off, and with more safety, than if the fough had been laid in the sand itself; which would not only increase the depth and difficulty of working it, but in many cases the level of the orifice will not admit of the drains being cut to such depth. Also, if, in cutting the trench along the tail of the rock, the level of the orifice will not admit of its being cut so deep as to touch the rock, the clay or impervious stratum that lies immediately

above it must be bored through, when the water will flow up through the fissures of the stone, and through the auger-holes, into the fough; but it is preferable, in cases where the level will admit, to dig the drain through the clay, and so far into the rock as will furnish stones for laying the fough; and then the water will meet with less resistance, and have a freer issue, than if the stone had not been opened or broken. This will increase the expence of cutting the drain, but lessen that of quarrying the stones elsewhere, and of carrying them to the place where the drain is made. Although in the ground to be drained there may be a ditch, or other old water-course, in which it may be practicable, by means of boring, to *tap* the spring, yet it is better to make a new trench, in which the water of the spring only can have admittance; and where this must cross any ditch or old water-course, it must be secured by *puddling* with clay, or be conveyed in a *wooden trough*, so as not to receive any surface-water: which, by being augmented in time of floods, might soon blow up and destroy the fough. As the water thus obtained by means of boring may be converted to several useful purposes, as those of irrigation, serving small mills, canals, houses, fish-ponds, pastures, fields, &c. caution is necessary in using the auger, lest the water procured in one part of the drain may be lost at another, in the same manner in which it was found; and, in the endeavouring to procure a greater supply, it may by that means be let *down* from a *wet*, into a *dry, porous substratum*, as will be seen in its proper place.

Such are the chief objects that require consideration before beginning to cut the drains: the following directions will be useful in guiding the execution of them. If the drain is to be cut through a soft boggy soil, it is better to be open than covered, especially where it may receive other water than that collected from below, and can at the same time serve as the side of an inclosure or division betwixt the upland and low grounds. Stones laid in such drains are soon apt to sink, owing to the softness of the bottom, and the fough may also be soon choked up. The width of a covered drain may be from three to four feet at top, and one and a half or two feet wide at bottom, thus allowing six or nine inches for each side-stone, and six inches between, for the passage of the water, forming a square conduit, or what is termed the fough, being also six or nine inches in height. Or, when the quantity of water collected, or to be conveyed in the drain, is small, it may only be coupled at the bottom. This is a considerable saving, both in materials and labour, requiring much fewer stones, and a great deal less time in laying them. It is equally secure when the bottom is solid, the stones good and properly laid, being well packed at the sides, to prevent them from shifting. It is also a saving in cutting the drain, as it requires less width at the bottom for this manner of laying the stones, than it does for a square conduit. In most cases, however, where circumstances are favourable, the other method should be preferred. The depth is regulated by the level of the place where the drain is to empty itself, and the nature of the ground through which it is cut, which is commonly four or five feet, and never less than three. Where the drain is only to act as a conductor for the water which is brought up by the borer where the soil is *all* clay, its depth may only be three feet, which will be sufficient to allow a proper depth of earth above the stones laid for the conduit at bottom, which need not exceed, nor should ever be less than one and a half or two feet. Drains are sometimes seen, in ground apparently very wet on the surface, cut to the depth of three and even four feet, and several hundred feet in length, without any water being collected by them; but when the borer

has been applied, and holes put down at the distance of six yards apart, and eight or ten feet deep, a considerable stream of water has been procured, and which has continued to flow. In a particular instance, a drain has been directed to be cut in a very retentive clayey soil, which, at the depth of four feet, met with no water; which gave occasion to the workmen to say, and the proprietor to think, that he was laying out his money to very bad account; but they were soon convinced to the contrary. As the drain had a smooth and uniform slope in the bottom, in order to expedite the work, several men were employed to lay the stones, beginning at the *lower* end, and proceeding upwards, while others were engaged in boring at the *upper* end, to proceed downwards. When those below began their work, the drain was quite dry, and had no appearance of water, either from the sides or bottom; but by the time they had proceeded a few yards, and two or three holes were made above, an unexpected stream of water made its appearance, to their no small astonishment; and which has since had the effect of laying dry a piece of very wet land. This fully shews, that without the use of the auger in similar cases, many drains may be cut to an extensive depth, without effecting the desired end, or without making any material change in the appearance of the land.

In soft boggy soils it is often necessary, where the drain is to be covered, to cut to a much greater depth than in other cases, or to the bottom of the moss, in order to have a secure foundation for the stones, as a great part of the water is constantly lodged between the moss and the next stratum. In digging the drain, it is best to cut the whole length to the depth of two or three feet, at which there is no danger of its falling in; and when the ground near it by that means has become more firm, and the stones have been laid down by the side of it, then cut to the depth required. In this way the stones are at hand, and ready to lay so soon as the proper depth is dug, and the laying should be begun at the upper side, proceeding downwards, smoothing and clearing the bottom of the drain. By this means, the fall of the water will be seen and kept, as there is a danger, when the work is begun at the lower end, and laying upwards, in level ground, of digging too deep in clearing the bottom, and thereby causing a stagnation of water and sludge in the fough, which ought to be carefully avoided. The turf, in opening the drain, should be first pared off thin, and laid to one side for after use, and all the mould thrown out to the other. The most difficult part of the work is laying the fough in running sands, where it is necessary to have the sides of the trench supported with flat boards and props, which are removed forwards as they proceed in working, and which keep the sides from falling in, and the loose sand from falling amongst the stones with which the conduit is laid. If the fough or conduit be laid with brick, a small aperture must be left betwixt each, to admit the water from the sides of the drain, and the thin turves must be laid above, grass-side downwards, to prevent the mould from getting through the openings. The turves are laid grass-side downwards, *immediately* above the *stones*, without any loose stones above the laid ones, as the water is all collected from the bottom of the drain, very little from the sides of it, and none admitted from the top; unless in such cases as where the stratum containing the water, or that may receive it in time of rains, is cut through to a greater depth than the height of the conduit, then small stones must be laid above the conduit or cover stone, to the height of such stratum, or as far up as the water appears to ooze out. These small stones admit the water to subside through their interstices to the conduit or fough below, and
thus

thus prevent the bad effects that would otherwise proceed from its confinement to near the surface. In quick or running sands, turves must also be laid at the bottom of the drain, under the fough, to prevent the loose sand from flowing up, and to render the foundation of brick or stone more secure in case of their sinking. Before boring, it is proper to lay the side-stones of the conduit; after which the holes may be put down, at the distance of every four or six yards. But if the water, on withdrawing the auger, rush up with violence, and continue to have a boiling appearance, it indicates a strong body of water confined below, and, consequently, requires a great number of openings to give it a speedy and sufficient vent. When the force of the water is great, the width of the holes enlarges, and consequently the discharge is increased. By a careful examination of the adjoining ground, it is sometimes possible to say at what depth the stratum containing the spring lies, and consequently how deep the *bores* must be made; but the general rule is to go down until the water rise immediately on withdrawing the auger. Thirty feet have been bored down before the water flowed in a full and free manner; but about from ten to fifteen feet may be said to be the average depths of boring. One case is stated, in which, after boring thirty feet, the water issued in a quantity equal to *three* hogsheds in a minute, by which a great extent of wet ground in the vicinity was drained. In these sands, it is also better to dig a little into the sides of the trench, off the line of the fough, where the auger is to be used, and, after boring, to cover the places in the same manner as the rest of the fough, leaving out a side-stone opposite the hole, as the sand thrown up by the spring can thus be more easily taken out with the hand till it subside and give over running, and is likewise off the main current, coming down the middle of the drain. That part of the fough above the auger-holes should be left uncovered till the sand is all thrown up, and the openings clear; but, till then, the sand must be taken out, and the fough may afterwards be covered up with safety. Above some of the auger-holes, or at any other convenient part of the drain, a kind of funnel may be built to the top of the trench with a flat stone laid over it, whereby it can at any time be looked at to see if the issue is clear, and if the quantity of water diminishes or increases. When the circumference of the auger-holes is not sufficient to let up the quantity of water which the springs would otherwise issue, where it is not far from the bottom of the trench to the stratum containing the water, and where there is a bed of hard gravel intervening, impenetrable by the auger, holes must be dug with the spade, down to the spring, and these holes filled up with loose stones; first putting down a round stake in the middle, which, after the stones are filled in, must be drawn out, which leaves an opening for the water to flow up. No apprehension need be entertained of the holes made by the auger being filled up, whether the drain be open or covered, provided no other water is admitted; for such is often the force of the spring, that it will throw up any earth or other sludge that may accidentally get into it; and it can be injured only by the admission of great quantities of surface or flood-water coming up on it at once. When flat stones can be got, they are preferable to brick for this use; but there are several kinds of brick besides the common sort invented and used only for the purpose of draining, in several parts of the kingdom, where the expence of stone would become greater. When small drains are wanted, and when the water is to be conveyed to a house, &c. that which is of the arched form is commonly made use of. For larger drains, those of the square, hollow, pantile form are well adapted, especially the latter. They are laid single,

without one reversed under; for when that is done, the water running on the under one occasions a kind of sludge, which in time becomes so encrusted on it, as totally to obstruct the passage of the water, and render the work useless in a few years. In clay bottoms they may be laid single, or without any thing under; but in soft sandy bottoms, a common building brick should be laid under each side to prevent them from sinking down, and be so laid as to form a regular arch, by the side-bricks being laid with an equal height, the better to support the pressure above from breaking them. They may be constructed in the above shape to any dimensions, suitable to the quantity of water the drain is to convey.

Although the earth that is thrown out of the drain should, when filled in again, be considerably higher than the surface of the ground on each side, it must remain so; for in a year or two it will subside to the level of the surface on each side. What remains may be spread or laid in some adjoining hollow; for, if levelled at first, the earth immediately above the drain sinks down, and the rain by that means lodging in the hollow and subsiding downwards, may injure the fough, by carrying part of the surface of the earth along with it.

While the drain is cutting, in very wet peaty soils, the surface-water, or what may ooze from the sides before coming to the spring, must be stopped here and there; and when let out to run through the fough, a turf or bunch of grafs must be laid so as to prevent any sludge which it may bring down from running through along with it, as this might choak the laid part of the drain and stop the passage of the water. When trees, especially ash, happen to be in the course of the drain, they must be entirely grubbed up, otherwise the roots will get into the fough, and expanding through the joints of the stones, will soon put a stop to the passage of the water. When the water issued by the drain becomes of a red ochrey colour, it indicates a stagnation either from the above cause, if amongst planting, or from some part of the fough having fallen in; which should be speedily repaired, otherwise the grounds will soon become equally wet as before. In the last place, the mouth of the drain should be carefully railed in, or otherwise guarded, to prevent the cattle from trampling it or choaking it up, being fond of drinking there for the sake of the cool water, even although there be watering-places in the field; and where there is any defect of this kind, it should immediately be remedied. Likewise the outlets of the drains where they empty themselves into an open ditch, or run of water, should be often examined and kept clear, as they are very apt to be choaked up with grafs and sand when neglected in such places. The first symptoms of the drain's having effect, and which soon appear when the spring is properly tapped, are, that all the *surface-drains* that may have formerly been made, and also any adjacent pits, ditches, or places to which it may have backed up, immediately become dry, and remain so afterwards. On the whole, it appears from the foregoing observations, that this mode of draining bogs, or land injured by subterraneous water, is by far the most effectual of any that has yet been suggested; and that such ground may be made completely dry, by cutting off one spring alone, with which the particular place to be drained may have no apparent communication, but which may be so connected under ground, that from it all the others derive their source, and being therefore the *principal* cause of the whole, to hit on it seems the chief desideratum of the business. Many instances of this have occurred in the practice of draining boggy land, under the direction of the above expert drainer, where by a few auger-holes, hitting upon the particular spot where the *lowest* part of the main spring lay, a considerable extent of

ground, with which the drain had seemingly little connection, has been laid dry, and caused much surprize to those who witnessed the effect. At Odstone Hall, in Leicestershire, a considerable tract of wet marshy ground, of very little value, divided in the middle by a small river, was so completely drained, it is said, by the same experienced drainer, by making a small trench at one side, and by boring in it, that the part of the marsh on the opposite side of the rivulet, which was at a very considerable distance from the drain, became, in a short time, equally dry with that where the cut was made; has continued so ever since; and, from being formerly of little or no value, is now converted into excellent water meadow, producing, *without manure*, abundant crops of grass and herbage.

At Madeley also, near the town of Newcastle, in Staffordshire, there was likewise a very considerable bog of some hundred acres, the drainage of which was deemed impracticable, being of so wet and soft a nature that no cattle could pass over any part of it, until this able drainer lately obtained a lease of it for a certain number of years, and, by means of a very little cutting and expence, has in consequence so effectually drained it, that it may now be considered as not only a singular instance of the success of this sort of draining, but as being likely soon to become highly productive as a farm, in consequence of other improvements, which this has produced, on it.

Extensive bogs too, which were formerly considered as incapable of being reclaimed, have within these few years been effectually laid dry, by this sort of drainage, at or near Woburn, belonging to the noble duke who resides near that town, at but very little expence, considering the manner and nature of the undertaking in such bogs. The drainage, in these cases, was accomplished by the same skilful drainer.

Successful drainages of this kind have also been performed in different parts of the northern district of the island: and particularly in the extensive park of the duke of Buccleuch, where the work has been carried on in exactly the same manner, and in perfect conformity to the principles, and the rules and directions which have been laid down for the drainage of the first class of these spring-bogs. In this case, the ground has not only been rendered dry and much more valuable than formerly, but the drains have likewise served the useful purpose of affording a constant supply of spring-water to different parts of the park.

It has been suggested by the writer of the Middlesex corrected Agricultural Report, that, wherever there may be any bogs, draining is unquestionably the first step to be taken towards their improvement; for the accomplishment of which, the principles and practices which have been laid down above should be resorted to, though the drainer should not be too sanguine, or imagine that it is, in every case, an easy operation. It is much feared, that there are *some* bogs which could not, without great difficulty, be drained at all; and *others*, that would cost the value of the land, in drains and machinery, to fully effect it. Yet, notwithstanding some *unsuccessful* trials may have been made, they should, it is said, not discourage or prevent the making of such attempts, in all cases, where there is tolerable prospect of succeeding in them. The instances are, no doubt, very numerous, it is thought, in which this sort of land may be effectually drained at an easy expence; and thereby be brought from a state of *annoyance* to yield considerable *profit* to the owners, as well as the community. See BOG, MORASS, &c.

Drainage of Ground on the Sides of Rivers, and flat swampy Land, below the Level of artificial Leads or Runs of Water.— It is also stated, that many extensive tracts of land are wet

and rushy, from a cause that cannot be removed by any number of open or covered drains. This is called *haugh* or holm-land, and lies along the sides of brooks and rivers, which having altered their course so often between the opposite banks, and depositing sand and gravel as they recede from their last channel, the water of the river constantly percolates through the ground thus formed to the level of its present course, keeping it so moist and wet as to produce rushes and other coarse aquatics; and wherever a drain or pit is dug in such ground, it immediately fills with water to the level of that in the river. Where the river has a quick descent, it is less apt to produce this effect; but where the current of it is slow, and the level of its surface little below that of the ground on either side, the soil will be very much saturated with water. Any number of drains cut in any direction, can have no good effect while the river continues in its present course at such a height. Consequently the only remedy, where it can be had recourse to at a moderate expence, is, it is supposed, deepening and widening the bed of the river, the earth taken out of which will, at the same time, serve to form an embankment on either side; for while it can rise higher than the outlets of the drains, and flow back into them, it renders the ground equally wet as before they were made, and the expence of making them is laid out to no advantage. Besides being injured in this way by the *river-water*, springs, in many situations, issue from the bottom of the higher banks or ground, and ooze through the soil higher than its level. The water of these can easily be cut off or lowered to the level of the river by a proper drain, as will be afterwards seen. As this sort of land is mostly formed by the rivers changing their courses, and thereby leaving considerable extents of flat level ground on one or both sides of them, which is of an alluvial nature, and commonly of a very rich quality, being for the most part constituted of very fine earthy particles, which are either deposited by the water in the time of or after floods, or washed down from the higher grounds in time of heavy rains, and sometimes by both; its drainage and embankment must consequently, when necessary and practicable, or capable of being performed without any extraordinary expence, be highly desirable and important. See HAUGH-Land.

But in some cases the wetness proceeds entirely from springs, where the soil of the flat ground betwixt them and the river does not consist of loose gravel or sand, but of a loam or clayey mixture. In order to drain this ground, a trench must be begun at the lower end of it, and brought from the river along the bottom of the bank from whence the springs issue. This trench should be cut *below* the line of the springs, where it can more easily be done, and kept open to receive the river-water in floods, and also any runs of water from the high grounds in time of rains, which would *blow it up* if covered; and must discharge itself into the river at the lowest possible level. Where the ground by the side of the river is of such extent as to render a regular embankment along the side of it a matter of consideration, a flood-gate might, it is supposed, be placed at the mouth of the outlet-drain, which would shut with the pressure of the river-water in a flood, and thereby exclude it entirely from the inner ground, and would open by that of the water accumulated in the drain during the inundation, and so be emptied into the river when it subsides. The construction of such a gate is simple, and the only remedy in cases where it is desirable to have the flood-water excluded in such instances.

From this trench, short covered drains must be cut up a little way into the bank, to lead in the springs that are
above

above it, where boring opposite to them has not that effect. The bottom of these must be higher than the level of that of the open cut, to prevent any of the water in it from flowing back into them. In these the auger must also be used to tap the springs, if the depth of this level does not reach the stratum containing the water. There will be no occasion for any cross-drains betwixt the open cut and the river, as all the water that is intercepted will be carried along the bottom of the bank, and emptied into the river at a lower level, unless the ground be of such extent that it may be divided by cross-ditches into separate inclosures. The open drain along the upper side will serve as a division betwixt the meadow and higher ground.

This sort of land, from its peculiar situation, and the nature of the soil, is mostly well adapted to the purpose of being watered after it has undergone proper drainage.

In cases where a mill-lead, or other similar artificial runs of water pass through land, there are many valuable tracts which are not unfrequently considered as impracticable in their drainage. Also where they glide along the sides of them to which the falls incline. From the low situation of the ground in such circumstances, and the height of the water in the leads or runs, there is no fall for discharging into them the water of any such drains as may be cut to the necessary depth. The only expedient for the remedying of this difficulty is supposed to be the following, which has been had recourse to in different instances, where no other mode was practicable, with the most complete success. In all such cases, the first thing is to begin, it is said, at the river or natural stream, and bring up a cut to the lead or run at the point where the outlet of the upper drain is to cross it. This cut must be as deep as the river will permit, or the drains above require. A cut must then be made across the lead or run to the same depth, and a strong wooden trough, or square box, for which larch wood is the best, made of a sufficient size to admit the water collected above to pass through it, be placed across it. The length of this trough must be several feet on each side more than the width of the lead or run, and must be secured by stakes firmly driven down into the ground on each side, with cross-bars or pieces above, to hold it securely down. The space between the top of it and the bottom of the lead or run, must be well filled with clay closely beat or rammed down. After this, the cut to the higher side of the ground may be made as deep as the level of the trough will allow, and continued along the upper side of the wet land, so as to cut off the springs that rise in that quarter. This may either be a covered or open drain, as circumstances may require. From the trough, also, an open cut should be made parallel to, and along the back of, the lead or run, to receive the surface-water from the ground above, and from the division ditches that may be necessary, if the ground be of great extent. The earth from this cut should be laid between it and the lead or run, to strengthen and secure the bank. In like manner, an open cut may be necessary along the other side of the lead or run, to receive the water that may ooze from it, and injure the ground between that and the river; and this ground, if extensive, may likewise be divided by cross-ditches, or such as serve the double purpose of fences, on the sides of inclosures, and drains. The cross or division ditches, in the upper part of the ground, should not join the upper drain, but a small space be left uncut, to prevent any connection between the spring-water in the upper drain, especially when it is covered, and that which is collected in the cross open ditches; and which may likewise serve as a passage from one division of the field to another. The parts of the land between the division

ditches are mostly well calculated for watering, where there is a full command and supply of water from the leads or runs.

Something of this manner of drainage has succeeded, it is said, in a case of land lying along the side of a river, below gently rising ground, where the wetness was commonly believed to be owing to a mill-lead penning up the water above the level of the low meadow-land; after attempts to drain it, on the supposition of the wetness originating from springs rising in the higher grounds, by cutting them off by means of a trench, had completely failed. This was lately done at Petworth by lord Egremont, according to the writer of the "Corrected Account of the State of Agriculture in the County of Sussex." In this case, the water in the river was higher than the meadow-land to be drained; but there was an old ditch for carrying the water from the low meadow-land into the river, at such times as when it was low. This ditch was intended to be stopped up in case of the success of the above mode of drainage, as the trench-drain would, it was thought, serve the purpose. But on the drain or trench being cut, the effect was, that when the ditch was stopped up, the low meadow-land was flooded by the springs, as the drain did not answer the purpose of taking away the water; and when the ditch was open, the same meadow-land was flooded by the river. The banking of the river out at the ditch, and the building of a wind-pump to render the ditch dry, were afterwards advised as the only means to be taken for accomplishing the drainage.

A different method, of somewhat the above kind, was, however, had recourse to with complete success. Upon the levels of the meadow-land, on each side of the river, having been taken, it was found that the meadow-ground on the opposite side was beneath the level of the meadow-land which required to be drained, and consequently that the drainage of it could be effected by a trunk-drain laid across the bed of the river; a wooden pipe was, of course, laid at the bottom, to receive and convey the water of the ditch, and which was carried on forward by an open drain being cut so as to pass through the other meadow-land, on the opposite side of the river, which was also drained by the cut thus made, quite up to the bridge under which it passes, close to the turnpike gate, fixed there by means of a pipe, and which empties itself into the river at the mill-head. This mode of drainage has answered, it is said, most effectually, so that the water in the old ditch now stands always a foot below the surface of the meadow-land which was wet; and more than one hundred acres of contiguous meadow-ground have been highly improved by the new drains which have been thus made: much of it, which was a mere bog or swamp before this drainage of it was completed, is now, it is said, converted into a fine water-meadow, and worth full three pounds the acre. These grounds are, it is remarked, at any time capable of being flowed by means of sluices made through the towing-path, which acts as an embankment; and in the summer season, if the river be too low, by fresh streams which flow into it from the upper grounds; and besides, the water can at pleasure be drawn off by drains into the lower level, below the locks, sometimes, when particular circumstances render it necessary, by the means of culverts carried across the bottom of the river. This interesting manner of freeing such low dammed up meadow-lands from the effects of the water so kept up in them, may be applicable in many other cases and situations of a similar nature.

Drainage in boggy and other wet Ground, by perforating through a retentive to a porous Substratum.—There is a sort of

boggy and other wet land, which is mostly caused in a different way than by that of springs, but which, as partaking in some degree of the nature of that kind of bogs, and being capable of having the wetness removed by such means as are had recourse to in spring-draining, may be considered in this place without impropriety. In many parts of the kingdom there are considerable tracts of land which lie waste and uncultivated, owing to wetness in a particular situation, that might, by means of letting down the waters into a porous under-stratum, be easily drained, and rendered much more productive. The cause of their wetness proceeds not from springs lying under the surface, nor from the overflowings of any of the adjoining higher grounds, but from the accumulation of rain-water stagnating on a retentive body of clay, or other impervious substance, through which the water can have no descent; and being also surrounded with higher ground of the same impervious nature, the water of itself can have no natural outlet. Such ground, when it becomes boggy, is commonly called *land-locked* bogs. The situation of these bogs being often so much lower than the grounds that surround them, the cutting of a main drain, or conductor, through the bank, for carrying off the water collected by the smaller drains, would, in many cases, be attended with an expence greater than the value of such land when drained. The thickness of the impervious stratum that retains and upholds the water is often so great, that although the strata under it be of a porous and open nature, as rock-sand or gravel, the water can find no passage whereby of itself to descend through the one into the other; and, therefore, by its long stagnation above, all the coarse vegetables that have, for a series of years, been produced on its surface, and even the upper part of the soil itself, are formed into a body of peat-earth, equally soft and less productive than that of any spring-bog, and which is only passable by cattle in very dry seasons, when the wind and sun exhale part of its moisture; and is even then inaccessible to the plough. The drainage of these bogs must be effected in a manner different from that of those above, or spring-bogs, the cause of both not being the same in their nature, as already seen. It may probably be done in the following manner at the least expence. The first drain must be made in the middle or lowest part of the ground, and into this all the others must lead. The number and direction of these must depend on its extent. They must be cut through the peat, or wet, spongy, upper soil, to the top of the clay or retentive sub-stratum, which must be perforated by the auger, in order to give an *outlet* downwards for the water, which will be absorbed by the porous strata below. The making one large pit or well in the middle or lower part of the bog, dug through into the porous substrata, with the drains leading into it, would answer equally well, and would save boring along each of the drains: this is a method which has frequently been practised with success in different districts. In Hertfordshire, according to the corrected account of the agriculture of that district, if a pit be sunk twenty or thirty feet in depth, in the middle of a field, through the red, flinty, and impervious clay of the county, into the chalk below, when the usual quantity of chalk is taken out, the pit-shaft is filled up with the flints which are collected out of the chalk and clay, and the top, or surface-drainage, of this part of the field, much shortened for ever afterwards, by making principal drains from the part of the field above the level of the top of the pit terminate therein, and the superabundant moisture will escape through the flints in the pit-shaft to the chalk below. And if a drain be carried into a limestone quarry, it is seldom necessary to carry it farther.

In dells or hollows of considerable extent, which are covered with an impervious stratum, and from which there is no natural drainage; such, for instance, as the valley between Mold, the shire-town of Flintshire, and the adjoining high land; a pit about four feet in diameter, and fifteen feet in depth, more or less, as the case may require, is sunk through the impervious super-stratum into a pervious stratum of gravel, and the rain-water, and that of some adjoining springs, are carried from the surface thereby: the pit is railed round to prevent cattle from falling into it. It is here remarked, that though in this, as well as in many other instances that might be given, the top-water escaped through the pervious sub-stratum, the effect might have been directly the contrary. It is, consequently, advised, that the impervious super-stratum, in all such cases, should first be perforated by bore-rods, as the holes made by them are easily stopped up.

Where the first method is had recourse to, the drains should be cut as narrow as possible, and, after the auger-holes have been made, should be filled with loose stones to within a foot and a half of the surface; and this vacancy may be filled up with part of the earth taken out, having a turf, grass-side downwards, next the stones. The water and noxious moisture, contained in the peat or upper soil, will be extracted by the drains, and will subside through the auger-holes into the porous strata below. If the ground is afterwards ploughed, care must be taken in forming the ridges, and giving them a proper descent towards the main drain, which will greatly assist the others in discharging any heavy falls of rain-water.

Before proceeding to drain this kind of land in the manner described, the following observation must be attended to. It should be discovered, in the first place, whether the porous strata immediately under the clay be dry, and will receive the water, when let down into it from above; or, being saturated with water itself, may, in place of receiving more, throw up a greater quantity to the surface; and thus, instead of remedying the evil, render it worse. This may sometimes be the case; and the substrata may contain water that makes no appearance on the surface, at *this* place, owing to the superincumbent body of clay, but which, being connected with some higher spring, may flow up, when a vent is given to it by the auger. Thus would a greater quantity of water be brought to the surface, which, having no outlet through the circumjacent bank, would render the ground much more wet, and might even, in some situations, almost form a lake. If the surrounding high ground declines deeper or lower than the bog, although at some distance, by means of a spirit-level, and the appearance of the surface, the nature of the under-strata may in a certain measure be discovered; and although it should already contain water, a drain may be there cut to draw off that water, and also what is let down into it from above.

It not unfrequently happens, that springs, or *spouts*, as they are commonly termed, rise in the middle of a field, or portion of ground at a distance from any ditch or open drain, into which the water may be discharged; so that a covered drain, brought from the nearest outlet, would pass so far through dry ground, as to render the expence of conducting the water from the spouty part greater than the injury done by it. In order to remedy this evil, it is necessary to begin by cutting a drain a few yards in length, or by sinking a pit into the porous soil immediately between the *lower* side of the wet and next dry ground; and from that to bring up an upright drain to the *upper* side of the wet ground, from which a branch must be taken to both sides, along the upper side of the wet, so far as it goes.

SPRING.

This upper drain will cut off the water, when it rises to the surface; while the upright drain will convey it to that cut along the lower side of the wet ground, where the water will subside into the porous subsoil. An easier method may be practised, where the retentive or impervious substratum is not deep, which is first to cut the drain along the upper side of the wet ground, and after coming to the stratum in which the water flows, either to bore through the retentive substratum, or cut the drain to that depth; by which means the water cut off above will be let down into the absorbent or porous stratum below, and thus be got rid of more easily than by any other method. But if the ground be steep, and the stratum, into which the water is let down, tails out any where below, or lower down on the slope or declivity, the water will again flow out, and cause a similar *spout* or wet place in the field. This, however, will seldom be the case, it is said, and may easily be remedied, by being made perhaps near the extremity or lower side of the field.

It has been stated, that Dr. Nugent, in his Travels through Germany in 1766, has shewn the mode of draining marshes in that country to be nearly on the same principles as those explained above. The draining of marshes is said to be conducted in much the same manner as that of lakes; but the operation has there been seen performed only on what we call moor or turf-grounds. These are most easily drained, by carrying trenches through those grounds, when the disposition of the country is such that the water can be conveyed to some neighbouring stream.

In these cases, the first thing they do is, it is said, to carry a ditch to the middle of the moor in a direct line, its depth and breadth adapted to the extent and wetness of the ground, and thus to the supposed quantity which is to be carried off. At every six, eight, or ten perches, as the ground is more or less swampy, cross-trenches on both sides are drawn in a direct line, and communicating on both sides with the main trench. But, in case of water coming from any neighbouring eminences, they dig a trench round the whole ground as a reservoir; and this likewise communicates with the main trench, &c. In case the draining of the water into some natural receptacle be not practicable, at least not under a very great expence, then they have recourse to sinking ponds or reservoirs in some neighbouring bottom, and to these they carry all the trenches. These ponds are likewise said to be of use as a fishery; but even if the sinking of such pond be too chargeable, there still remains an expedient which is of good effect, and chiefly if the moors are not too wet and marshy. It is the nature of moors, in general, that, beneath the turf or moss, there is a loam which hinders the moisture from penetrating; and this, indeed, is what makes the marsh, and causes the luxuriant growth of the turf or moss: but this loam or clay is only a stratum, and far from being of an immense depth; under it is generally a sand, or some other stony or loose soil. Here reason readily informs us, it is said, that a middling morass may be drained by *perforating* the clay, and thus making way for the moisture to penetrate. In order to this, a pit is dug in the deepest part of the moor, till they come below the obstructing clay, and meet with such a spongy stratum as, in all appearance, will be sufficient to imbibe the moisture of the marsh above it. Into this pit the ebbing of the morass is conveyed through a trench, and both the trench and pit are filled up, after the first drain, with large broad stones, setting them edgewise, so as to leave interstices for carrying off the water: then such stones are laid over breadthwise, and these covered with loose earth, like that on the surface. When no such stones are

to be had, strong piles are rammed down the sides of the trench, and broad boards laid across; and these are covered with earth to a height fit for culture. This is a matter of no great expence, the pit being as near the morass as the water will admit, and the trenches but short; then they have a drain unperceived, which leaves the surface of the trenches for the plough. And in middling marshes, or especially in such moors as are only wet and damp, this method, though sometimes slow, never fails taking effect; and many tracts are thereby made serviceable to the farmer or grazier. Much land, in some parts of this country, has been drained in the manner here described.

It has been done with great success, to a considerable extent, near Aberdeen, in Scotland, as well as in the county of Roxburgh, according to the writer of the Agricultural Report of that district, on such waste lands as might be made arable, in which, at the depth of from one to six feet below the surface, is found, it is said, a large seam of black slaty or metallic substance, generally from twenty to twenty-five feet in thickness; and below this is discovered a mass of whinstone rock, both lying in a tolerable regular straight line. The thickness of the whinstone rock, it is supposed, is unknown, as it is not believed to have ever been bored into. The black slaty or metallic substance is commonly found so closely cemented, as it were, without chinks or fissures, as that it is impenetrable even to water, or any other liquid; while, on the contrary, the whinstone rock, when come at, abounds with chinks and fissures, and will receive and swallow up any quantity of water that may be poured into its bosom. The surface of the earth, above the slaty or metallic substance, is found every where of a light, kernelly, and mossy nature; apparently having, in the course of a series of ages, been produced and formed from the vegetable substances which had attached themselves to it; falling in the autumnal seasons, and having no receptacle to receive the rain-water, as it falls below its stratum, it preserves it on its surface; and in the winter months becomes swelled and enlarged in a considerable degree. In the spring months, when the sun and wind absorb it, and cause it to exhale, the moss becomes of tolerable firmness, and produces a coarse kind of unprofitable grass, mixed in many places with a sort of short heather, which is of no use either for the rearing or feeding of sheep or cattle.

Two portions of this sort of waste land, amounting to twenty acres, the one lying nearly on a level, and the other on the slope of a hill, were broke up in the autumn of the year 1784. The level part was gathered up in small ridges, ploughing rather deeply, and making the furrows narrow; labourers being employed, after the ploughs, to remove any obstructions that might arise from stones or roots, as well as to turn the upper rind or surface underneath, when not effected by the ploughs. It was then allowed to remain in that state until the middle of the summer of 1785, being only eaten and trodden in the spring season by sheep and cattle, which were occasionally driven about the ground for the purpose, the benefit of which was very great. At the above period the land was again gathered up; but finding, although the ridges were getting high, being only set out eight feet at first, the plough did not reach or get to the slaty substance in the hollow of the ridge, it was necessary to lay out the ridges to sixteen feet. This cost much trouble, but the plough was at last got down to the slaty substance. When the work was so far advanced, the next business was directed to the getting the water drawn out of the hollows of the ridges, which were at least four feet below any level that could be obtained. In order to accomplish this, a pair of bore-rods was procured, and put down

the slaty substance, to the whinstone rock, at sundry places, and which effectually answered the purpose; the tops of the holes or canals being kept covered with a basket of loose stones, which was allowed to remain or to be removed at pleasure, as the weather proved more or less wet.

By this means of draining, the land was found to be, in the spring of 1786, brought into a condition for sowing, nearly as early as any other part of the farm; the winter rains falling through the soil upon the ridges into the bosom of the slaty substance, which was laid bare in many places, in the hollows of the ridges; the water was gently drawn off, and glided regularly into the bore-holes or canals: and the production of crops in the following years was very good.

On the contrary, the other part of this wet waste ground, lying on the slope of the hill, was ploughed in thin broad furrows; using the same measures and precautions as in the above case, and being allowed to remain to the same period, after breaking up, was then endeavoured to be brake-harrowed, and afterwards prepared for burning. But both these methods failing, it was left in a more backward state than the former part; and was at last, in the spring of 1786, after two ploughings, braking, &c. being left in a large lumpy condition on the surface, sown with pease, in drills, in a close manner, for the sake of shade and the improvement of the land; which had these effects, besides producing a good crop. The after-crops on it were likewise good.

As the soil above the slaty substance, in this part, was not above two feet and a half deep, the plan of setting off the ridges eight feet in breadth is said to have answered well.

Drainage in hilly Lands and Sheep-Pastures, with the means of procuring and raising Water for certain Purposes, &c.—In hilly districts, and other steep places, where sheep are the staple or chief produce and stock of the land, less attention seems to have been paid to the drainage of such parts of their walks and pastures as are wet and unproductive, in the opinion of the writer of the work on draining, according to Mr. Elkington's principle, than to that of arable ground, although the effects in the one case are equally beneficial with those in the other. This neglect is often attended with considerable loss. From the nature of the herbage which a superabundance of moisture produces, whether stagnant on the surface, or long confined under it, proceeds that almost incurable malady the rot, to which so many thousands of valuable animals fall a sacrifice. For this, draining is a most infallible preventive; and in such situations it is attended with little expence, as the drains may, for the most part, be left open, with here and there covered passages, over which the sheep may cross with safety. It is stated to be the practice, in many of the southern sheep-farms of Scotland, to cut small open drains in the wet pastures, only one foot in width, and the same depth; but this, it is believed, has very little effect either in carrying off the superfluous water, or preventing the rot in the animals. One rood of such a drain, as has been advised above, would answer these purposes, it is thought, more effectually than fifty of the other, and, on that account, would not be more expensive.

And although in places where the depth of the cut does not reach the spring, the auger must be applied, no apprehension need, it is thought, be entertained of the holes filling up, where the drain is left open; for the force of the spring will, of itself, throw up any sand or sludge that may get into them, provided no great quantity of flood or surface-water is admitted. But the better to secure them

against any obstruction, small openings may be made along the upper side of the trench: and in these the perforations may be made, leaving the mouth of the auger-holes about six inches or a foot higher than the bottom of the drain, which will be without the reach of the water that may accumulate in time of rains. From the irregular disposition of the component strata, the sides of many hills are covered with alternate patches of wet and dry soil. By the appearance of the surface, and by the vegetables it produces along the declivity, the internal strata, and manner in which they lie, may often be ascertained with such a degree of precision, as to guide the direction of a drain without investigating *below* the surface; for the difficulty or facility with which such ground may be drained, depends entirely upon the *lie* of the different strata of which the hill is composed, and upon the perpendicular or horizontal inclination of the rock or body in which the water is contained. If the rock lies in a horizontal direction, all the different outlets or springs that appear on the surface may proceed from, or be connected with, the same body of water, and may all be *dried up*, by cutting off or letting out the main body of water that supplies them, at the lower part of the reservoir, or place where the water would of itself run off more easily, if it was not confined under an impervious covering of clay. But, where the rock lies in a perpendicular manner, and contains only partial collections of water amongst the more open fissures of the stone, which empty themselves at numberless outlets unconnected with one another, it would be preposterous to attempt cutting them off by *one* drain, or by *tapping* any particular one of them, without a drain being cut into each. In this manner it is better to cut the main drain *all* in the clay, with small cuts up to each outlet, than along the line or place where the springs break out, as it would in that direction be *too* much in the *rock*, and difficult to cut, from the nature and inclination of the stone. Where the water issuing out in certain parts, can, by means of the auger, be hit on in the main drain, at particular points it will be more effectually cut off; but if that is not practicable, the depth of the small cuts will reduce it to such a level as to prevent its overflowing or injuring the surface *below*. In many hills composed of alternate strata of rock, sand, and clay, the surface of the latter is commonly wet and swampy, while that of the former is dry and productive, and therefore requires as many cuts to drain it completely as there are divisions of wet and dry soil. The highest part of the hill, being for the most part composed of porous soil, receives the rain-water which descends through it, till it meet some impervious stratum, as clay, which obstructing its percolation any further downwards, it then rises to the surface, and forces itself a passage over that impassable stratum. After it has thus overflowed the *upper* clay surface, it is immediately absorbed by the next porous stratum, and, descending into it in like manner as above, it again issues at the lower side of it, and injures the surface of the next clay-bed, as it did that of the first. In this manner the same spring will affect the other similar strata of which the hill is composed, down the whole declivity, and form at last, in the hollow, a lake or bog, if there be not a proper outlet or descent to carry off the water. In order to drain a hill-side of this description, it is necessary, it is said, to begin by making a trench along the upper side of the *uppermost* rushy soil, which will have the effect of cutting off the highest spring; but as the rain falling on the next porous soil subsides to the lowest part of it, and forms another spring, and as it may likewise be partly supplied from some other internal source, a second cut is necessary there, to prevent that water from injuring the surface of the next clay-bed.

bed. Thus, similar cuts will be requisite lower down the descent, so far as the same springs and appearances continue to injure the ground, which may produce a quantity of water sufficient to irrigate the lower ground, or which may be useful in some other respects and manners.

In some hills, the strata of which they are formed lie so regular, that it is practicable to extract the water from either side on the same level, which would be a very considerable advantage in draining the one side, and in irrigating and procuring water for the other; for there is often found on the one side a wet swamp, and on the other the soil is too dry. This is owing to the bed of clay that upholds the water not lying horizontally, but *dipping* more to the one side than to the other, and by the one (the dry) side being *overlapt* by a covering of clay, whereby the water is forced to issue at the open side; but if an outlet is given to it on the *dry* side, by means of a drain lower than that from which it flows on the wet side, the course of the spring may be easily diverted. The opposite side being porous, and covered with sand, will act as a reservoir, to receive the rain-waters, which will afterwards flow through the opening made in the clay. This may be of great use in supplying a house with water that is situated on the dry side of the hill, and save the additional expence of conveying it in another manner. Care must, however, be taken in conducting the drain for conveying water to supply a house, &c. not to cut it or bore in it so deep as to reach a porous stratum, otherwise the water that may have been found at one place, may, by the same means, be lost at another. Puddling may, it is supposed, in some degree, secure it, but not in every case.

A spring in a low situation, adjacent to higher ground, may be raised to supply a house, or for any other useful purpose, although much below that level, by confining it in a pipe, or brick chimney. The reservoir from whence the spring or outlet of water is supplied being confined, and pent up between two impervious strata, and the upper part of it extending perhaps to a considerable height and distance in the high ground, it is evident, that if a perforation be made through the superincumbent stratum into the *tail* or lowest part of the porous stratum containing the spring, the water may be raised by confining it nearly as high as the level of the head of the reservoir. Of this kind there have been, it is said, several instances in actual practice, where the water procured from draining low grounds has been raised to a considerable height above the level of the drains. The drains in such cases should be closely built with brick, and puddled above with clay, to prevent the water from oozing through the joints. It is thus made to rise, through some sort of confined passage, to the height which is required, by the pressure which it receives in the high ground. The advantages of such operations, it is remarked, must be very great in many situations, and may often be accomplished with success, where many would think them impracticable. Of the practicability of this, however, and that water may often be raised to a very considerable height, by means of its pressure in distant ground, the following remarkable occurrence, which happened lately in digging a well in the vicinity of London, is a proof: earl Spencer, for the preservation of his noble mansion-house at Wimbledon against fire, and to be well supplied with water, ordered a well to be dug at a little distance from the house, which was sunk to the amazing depth of nearly 600 feet, before any spring was found. It was begun on the 31st of May, 1795; and on the 12th of August, 1796, the man who was employed in the undertaking, gave a signal to the person above to draw him up, as he had found the spring, and was immersed in water so

deep, that his life became endangered. In the space of four hours the water rose to the height of 350 feet, and during two days following its increase was more than a foot an hour. The water, proceeding from a rock, is remarkably fine, and, from the strata it passes through, is strongly impregnated with mineral qualities. As there is no extent of higher ground near that where the well is sunk, and as the depth of it is some hundred feet below the bottom of the Thames, the source of the reservoir from whence the spring is supplied, must be situated at a very great distance, and must contain a very large body of water to raise it so suddenly to such a height.

There are many other cases of wetness in the deep moory or heathy grounds, which often take place and occupy the bases of the narrow vallies at the bottoms of such hilly lands, hang on the sloping surfaces of their sides, or spread over the more flat lands which lie at their feet.

The most simple case of this kind is probably that in which the more superficial parts of the soil are of an impervious or porous nature, the subsoil of the absorbent porous kind resting upon a repellent impervious base or bottom; the porous subsoil part being uniformly charged with the descending waters, which are conveyed or brought down from some internal higher source, by a substratum of the gravel or other preconducting kind. In these circumstances, where the under soil is sufficiently free and open, a single drain, properly made or cut across the lower margin or edge of the rising ground, may be fully equal to the prevention, even of the flatter lands below it, from being surcharged with water. But though this may be the case, such an easy mode of removing the wetness may not always be the most suitable or proper, but must be decided upon by the full and mature consideration of the particular case; as it is in cases of this nature that waters for different useful purposes are to be procured, and the higher they may be drawn off, the more capable they will, for the most part, be of becoming beneficial in such ways: besides, where the absorbent porous stratum of the lower lands is not sufficiently open to permit the waters of a wet season to pass so freely through them as to prevent a temporary surcharge, a threefold benefit, it is thought by some, may possibly arise, by cutting and taking off the internal descending waters at the foot of the sloping ground. As, in addition to the advantages already suggested, another good effect may be produced; which is that of taking off the *weight* of the waters which are pent up in the higher grounds from the lands below; and thereby relieving them from a common disease or complaint to which lands so situated are very liable; and which is occasioned by the water, thus compressed, being forced up, through some fissure or defect in the soil, to the surface of the ground in some particular part or parts. But by a suitable fully efficient drain, made all along the upper margin of the flatter declining grounds, they may be entirely relieved from such internal descending waters, and become in a healthy productive state. It may, however, be added, that a drain so made, is in general more difficult and expensive in cutting, than one which is formed at the lower part of the more flat declining land; the soil at the foot of a slope being commonly of a greater depth than it is either above or below that part; besides the additional labour and trouble in cutting and sinking the trench when to be fouled or filled, and still more in keeping an open drain free, by reason of the greater press of water in that part. The upper side of the trench too, in such cases, is liable to shoot in; especially if it be sunk in a wet season, the water acting the most forcibly there. Besides, unless the trench

be sunk or cut down to a firm basis or stratum, it is ineffectual; the lands below are still liable to be affected with a portion, at least, of the descending waters; besides that which may fall on the particular surface of them. They consequently demand nearly the same labour to render them dry, as they would without an ineffectual drain being made along their upper margin or border; notwithstanding, however, in many instances, water, descending internally from a higher or more elevated source, and insinuating itself beneath the superficial soil of the lower grounds, so as to injure them, may be cut off by a drain running along at the foot of the lilly land, when cut or formed to a proper depth, as to the solid or impervious body; which may, at the same time, sufficiently relieve the lands which are below, as well as afford a valuable supply of water for different economical purposes about the farm or ground.

Another case of this kind of draining is where the superficial parts of the soil are of a porous or repellent quality, and the under or subsoil open or various, and partially charged with descending waters, passing through beds or veins of the sandy, gravelly, or fissured rocky kinds. This is a situation of land which occurs more frequently than the above, but from which it principally differs, in the manner in which the internal waters act upon the lower lands. Instead of being diffused, in an uniform manner, beneath the soil, they enter or come into the substrata in collected streams; and unless the subsoil be singularly open, and spreads out in an even manner, operate very irregularly on the land. Thus, if the soil be deep, and of an impervious or repellent quality, plots of cold wet land are formed and produced;—if thin, and of a porous freely absorbent nature, moory excreescences are raised on the surface; and if the stream be powerful and narrowly confined, a spring or fountain is the consequence.

The nature of the means which are to be pursued in the removal of the wetness in this case is of a more complicated kind than in the preceding instance. In cases where the supply of water cannot be cut off, the circumference of the flat ground is to be relieved by covered drains formed in a greatly declining manner from the diseased parts, to a common drain or outlet in some proper place. In this case, the supply of water is cut off with less certainty, than when it is conducted by an evenly charged stratum, resting on an impervious or repellent base or stratum. It may have only one, or many conduits situated at different depths. This too is a case in which the supply of water, with a sufficient fall, may take place; and under circumstances which particularly demand it, every expedient should be had recourse to in order to intercept the descending waters at the foot of the slope on the higher side of the lands which are to be drained.

A third case of draining in these situations is, where the surface-soil is impervious, or open and absorbent; the under soil porous and absorbent, with a closed bottom, and charged with descending waters, resting on an impervious or repellent base, which has an under base that is open and freely absorbent. This is a situation of land that may not often occur in such a state as to have the stratum or base on which the water rests, only of a few feet in depth or thickness; but in which, it is probable, an open or porous stratum may not unfrequently be found, by careful examination, at a greater depth; particularly when the land is situated below rising ground, at the base of which such a stratum is indicated to be present, by the flowing of a natural spring or fountain.

The means of removing the wetness in such a case as this,

is obviously that of opening a communication between the impervious or closed and the open porous strata; in order that the injurious waters, which are pent up in the former, may be permitted to pass down into the latter. It is in this way, it is said, that marle-pits are drained in some districts, as in Norfolk; the beds of marle which hold up the water being cut through so as to let it down into the great body of sand on which they rest. In order to effect which, a large earth borer naturally presents itself; and where the subsoil is free and open, and the surface-soil in a state of *perennial herbage*, the operation of it, when duly directed, and performed in a suitably dry season, may be found very effective for the time, if not durable: in the practical management of which a thick turf is to be raised on the surface, and at the bottom of the little pit which is made thereby, the borer is to be inserted, the turf being returned into its place, as soon as the work has been completed, in order to prevent extraneous matters from getting into and obstructing the opening made by the borer.

In land under the *arable* state, the operation may not, it is supposed, be so efficient; but, however, if pits were sunk down beneath the soil, it is suggested, so as to secure the tops of the bores from the operations of tillage, as to the depth of twelve or fourteen inches below the surface, sods being then laid over the tops of the bores, and the excavated soil or mould returned to their places, such drains might continue efficient for a short length of time. In cases, however, where the subsoil is so *tenacious* as to stand in need of many drains to draw the water effectually out of it, this mode of draining, or the use of the borer, it is thought, would appear a less eligible practice. In the bottom of a drain, whether open or covered, more or less current takes place, by which earthy matters are liable to be washed down into the bores; and these, in consequence, to be choaked up. The operation and effects of water falling down a pipe or tube, and that of its rising in them, are, it is thought, perfectly different; as rising waters loosen, and force upwards the obstructing matters they may meet with in their passage; whereas falling water, on the contrary, adds the pressure of its own weight to that of the obstructions; and by dissolving earthy matter, and thereby filling every chink and cranny, tends to close up the passage in the most effectual manner. Rising waters too enter the pipe or tube in a pure state, leaving their impurities below, while falling water carries down with it all the foulness that its current is capable of bearing to the mouths of the orifices of such pipes or tubes. Hence, even under the first mentioned circumstances, it is probable, it is said, that the salutary effects of the bores would only be of a temporary nature. Besides, where drains are necessary to extract the water from the subsoil, why, it is asked, may it not be collected into a body, and be carried away upon the surface, where it may in many cases be applied to different useful purposes?

Where, however, a superficial descent cannot be had for the water thus collected, and an open stratum lies beneath the subsoil, which is ready and fit to receive it, the making of a communication between them becomes a point of great advantage and importance; as the trouble and expence of raising and removing the water by other means may be avoided.

In all such circumstances of land in these situations, the lowest point of the space of ground to be drained is to be ascertained, in which it is advised to sink a shaft down into the receiving open stratum, which is then to be filled up, to within a few feet of the surface, with rough clean stones, the roots of trees, or other open materials; on the top of which

which a filter is to be formed with heath and gravel, or any other substances which will prevent earthy matter, or water in a foul state, from entering the shaft or opening. The collected waters are to be led to this filtering drain or opening in all cases.

Where, however, the water is collected by means of covered drains, and where the filtering parts have likewise coverings placed over them, the whole process will, it is said, be free from external injury; and drains or works of this kind might, it is supposed, remain unimpaired for ages, or a very great length of time. Even if the waters were collected by open drains, and the filters, or filtering parts of them, were suffered to continue in a state of neglect, until the shaft, in the course of time, should become defective, the remedy, it is thought, would be easy; as by embracing a dry season to re-open it in, and to clean it, as well as the materials with which it may have been filled, from their impurities, it may be restored to its original condition at but little expence or trouble. It may be noticed further, that where the land to be drained and improved is liable to have any other surface-water coming upon it than what falls upon its own space, such waters ought to be drawn and conducted away from it superficially, by cutting it off at such a height as will gain a sufficient fall. And further, when the quantity of water which descends into it subterraneously, or which would descend into it if a free passage were opened for it, is found to be too copious to be readily discharged by such a drain or shaft in the manner here proposed, proper means should be taken to cut off the supply, or as much of it as may be, by making a perforated trench, or otherwise, at a sufficient height to be able to convey it away in a superficial manner; and with a suitable fall, so as to prevent its entering the space of land to be improved; which by this means will only have its own superfluous waters to discharge by the shaft-drain. See *SHARP-Drain*.

There are many instances of low, flat-lying, moory valleys in different districts of the kingdom, and especially in Norfolk, from the bases of which it would be difficult to make superficial drains, which have for their substrata or substructures, most probably, infatiable beds or depths of sand, or sandy matters, in which this mode of draining might, it is said, be practised with vast benefit. The practice in these cases also affords additional explanation of what has been said above, in speaking of the removal of the wetness of land by perforating through a retentive stratum to the porous one below, as well as the nature of the drainage in bogs arising from springs.

In cases where the superficial soil is impervious and repellent, or porous and absorbent, the subsoil being uniformly absorbent, but closed in the bottom part, and charged with rising waters, the effect produced varies in some measure with the nature of the furcharged lands. Where the absorbent substrata are imperfectly closed, or where the furcharging waters find some other partial vent at the same level, the effect is merely that of an under soil, which is liable to be saturated in a wet season, and which is left dry after a long continued drought. But where the subsoil of the land to be improved, together with the substrata in its vicinity, on the same level, are equally impermeable, and the embanked waters are, in consequence, under the necessity of rising, to a higher level, the lower lands become subjected to perpetual furcharge: even the surface-soil, when in any degree absorbent, becomes liable to a similar degree of saturation, by reason of the weight of water which lies above it; as the compressed waters, acting in conformity to the general law of fluids to gain a common level, press upwards against the soil: and where this is freely

and uniformly absorbent, it becomes fully saturated; the inevitable effect of which is a bed of super-aquatic plants; and, in the course of time, an extent of deep moory bog: if partially absorbent only, plots of moor are the consequence.

The means of relief in cases of this nature are much the same as those in the first of the above cases. Where the subsoil is uniformly free, and a supply of water is not wanted above what is called the running level of the lower margin of the land to be improved, a trench, with a sufficient outfall there, will lay the whole effectually dry; and will, in addition, become the common outlet of the internal waters; instead of the natural spring, which will consequently cease to flow.

But if, on the contrary, the subsoil be not sufficiently open to permit a free passage for water through it, or where economical intentions demand a fall from the upper margin, it will be right and proper to attempt to take off the head and weight of the water, by a trench made at the foot of the hill; and then to free the space of land diseased by one or more drains, as the particular circumstances of the case may direct. Where a supply of water is particularly desirable, or the improvement of cold lands, hanging on the slopes of rising grounds, is wanted, it may be the most proper, when it is found that a deep trench alone, made at the foot of such slopes, by reason of the too great depth of the impervious or repellent materials, is insufficient for the purpose, to try the effect of the borer, and by this means endeavour not only to accomplish the supply of water that may be desired, but by bringing down the surface of the subterraneous collection to a level with the bottom of the trench, to relieve the plain below from the upward pressure; and thereby probably remove the evil in a sufficient manner, especially on the higher side, without additional trouble and expence.

In cases similar to the above also, where a freely conducting stratum, which is charged with water, lies too deep to be easily reached by a trench, and too level to be relieved by the borer, and in all cases where the water lies too low, and in too flat a situation to admit of a superficial channel being sunk deep enough to draw it from its natural bed, yet without an open stratum beneath to render a shaft-drain effective, a well-drain sunk in the lowest part of the ground to be improved, may, it is supposed, be had recourse to with good effect. See *WELL-Drain*.

In cases where the quantity of water to be raised is considerable, and the depth at which it lies not more than six or eight feet, it may be forced up into an open drain, sunk to about half the depth, by the use of the common draining-mill of marsh-land districts: or, where the depth is too great, or the substrata too loose and unstable to admit of a deep open drain, and that of an arched one too expensive, a pump wrought by wind, or by water, where a sufficient stream can be commanded, may be sufficient to raise it to the surface; care being taken in this, as well as the above case, that no extraneous waters interfere. See *SURFACE-Draining*.

There are other cases of draining besides these, in which the wetness is removed by drawing off the springs that cause them. See *TAPPING Springs*.

Cases of the same nature as those given above are illustrated by means of sections, in all the different instances, by the writer of the work on "Landed Property."

In many cases too, a great deal is capable of being effected in these and other sorts of hilly grounds, and very astonishing effects produced, in some instances, by means of cuts or drains alone, properly directed, without the necessity

of either boring, or having recourse to the making or sinking of pits in the land, for removing and taking away the wetness. It has been found that fields or grounds of considerable extent, which lie upon irregular banks, hills, or knolls, have been readily drained in this manner; though the water which rose and issued out from the springs in particular parts of them, rendered them before of but very little value: and though many drains, in improper directions, and not properly cut, had been before formed in them, at great expence, for draining off the wetness without effect. This has been accomplished by cutting drains to suitable depths through the porous strata, and in such directions as to cut off the springs coming from the higher grounds; or to take the water of them away, which lodged in the hollow parts of the land. Such drains have often speedily removed the wetness, without costing a tenth part of what was paid for the others, or taking into the account the difference of keeping them in order, which must be a mere trifle, when compared with that of the others, as they were mostly on a loose bottom, and made so small, as to be readily choaked up and destroyed. The nature of the situation, and the lie of the strata of which such lands are formed and composed, readily explain the reason why the moisture in such cases is so quickly removed by properly cut and directed drains, as it arises, in most instances, from the inclination of the strata, which is commonly towards the hollow parts of the grounds, and from their frequently terminating on the sides of such banks, hills, or knolls, under the impervious, clayey, marly, or stiff loamy strata, though for the most part upon them.

Mistakes in the modes of cutting the drains, and in the directions they should have for properly intercepting and taking away the water of the springs, are almost every where in such cases committed, and vast expence thereby not unfrequently incurred; it is consequently of much importance, in all such instances, to have a proper plan laid down before any part of such works be undertaken.

There are sometimes springs and wetnesses found on the tops of banks and hills, where the ground which is contiguous is much lower on all sides; but in such cases they are, in many instances, supplied with the water from higher ground at a distance, by means of metallic, mineral, or other substrata, lying in a particular curving direction, between impervious strata, from the higher parts of the land to the lower. The springs, in these cases, issue forth at the points where the metals *crop* out.

The drainage, in such cases, is to be accomplished by forming suitable outlets for the water, and by boring or sinking pits through the porous or metallic strata, so that the water flowing through them may be intercepted, and reduced to such a level, that the source of the springs may be cut off, and the ground on the top and on both sides of the declivity become dry. By this means the metals, to that depth, may be rendered capable of being wrought, without any inconvenience from the water.

In the above method, the continuation of the strata is supposed to keep on the same rise, in the high ground on the north side of the rivulet, to a much higher level than the line of springs, by which means, the springs issuing from the *crop* of the metals are supplied.

By bringing up a cut from the rivulet into the bank an outlet will be obtained for the water, free from that of the rivulet; and by boring or sinking a pit, the water flowing through the porous strata will be reduced to a level, and of course the source of the springs will be intercepted, and the ground on the top, and on both sides of the declivity, become dry; and the metals, to that depth, may be wrought free of water.

This could not be effected by boring from the bottom of the rivulet, or any run of water, for the pressure of the running water above would prevent that below from rising freely, and small stones or sand would be lodged in the hole. If the strata crop out to the surface, and cause wetness, the pit or bore may be continued till it reach it; but lying at such a depth, and covered with so much clay on the surface, the water contained in it may do no injury to the ground above it.

Drainage in Lands composed of alternate Beds of Clay and Sand; and other mixed Soils.—In districts where the soil is composed of an intermixed variety, and where clay forms the most predominant part, draining is, according to the first writer above noticed, a work attended with much greater difficulty and expence, than in those where both the surface and internal strata are more regularly disposed. In these kinds of soils, where every reservoir of water is unconnected with another, being separated by intervening beds of clay, the partial collections of water that these reservoirs contain are so much augmented in time of great rains, that, being full to the level of the surface of the surrounding clay, the water having then a free issue, as over the edges of a dish, so overflows and surcharges the surface of that clay, and renders it so wet and sour, that its produce becomes every year more scanty, and the nature of the soil itself more barren. As these sand-beds have no communication with each other, it requires as many drains as they are in number to extract the water from each of them. From the nearest and lowest part of the field to be drained, a trench must be cut up to the highest or most distant sand-bank, in such a direction, as, if possible, to hit on some of the intermediate sand-beds, and save the making a longer side-cut, otherwise necessary; but where this would give many awkward turnings to the main trench, it would necessarily lengthen it; and where, by crossing the beds in places higher than the surface of the surrounding clay, it would considerably increase the depth of it, and be difficult to work, especially if rock or running-sand; drains in form of the letter Y must branch off to such beds, to draw off the water they contain, and convey it into the leading one. Although the sand-beds throw out the water they contain on all sides, so as to injure the clay-surface immediately round them, a drain on the one side will completely extract the water from the whole, and prevent it from breaking out at either side, provided that where it is cut be the lowest. It may be observed, that unless the drain is so cut, it cannot be supposed to have this effect, while the water can find an outlet on the opposite side of the bank, lower than the bottom of the drain. This ought, therefore, to be previously considered; and by carefully examining the ground, and applying the spirit-level, the proper side for the drain may easily be found: or, if the water bursting out round the bank has been observed in dry seasons to run at one place, and not at others, it is a proof that this is the lowest point; and by cutting the drain in the direction of this level, the water will afterwards be prevented from rising to the height of the upper outlets, or above the level of the bottom of the drain, even in the wettest seasons. In many cases, the whole water that causes the wetness, and supplies the other sand-beds below, may arise from the upper springs, passing over the upper soil, and through the different sand-beds; by being prevented from descending deeper than the retaining bed of clay. In this case, the drainage of the whole field may be accomplished with much less difficulty and expence than in the former. After the main conducting drain from the outlet has been cut, a drain on the upper or higher top part, quite across, must next be made, which will intercept and cut off

the principal springs, and may by this means render the lower drains, on the different sides of the main conducting one, unnecessary, unless merely to extract the partial supply of water which the lower sand-beds may receive in time of rains, and which, where these sand-beds are of small extent, can do little injury to the adjoining surface. From this it appears, that one spring rising in the highest ground may be the sole cause of injuring a considerable tract lying below; from its water overflowing the surface at one place, and subsiding into it at another, according to the tenacity or openness of the soil; and therefore, in such cases, the upper spring, or *feeder*, should be first cut off, and the effect of that known, before any more drains are made in the lower ground.

Besides soils corresponding to this description, there are others nearly of a similar nature; but each bed being of less extent, and lying more regularly together, their drainage can be more easily effected, by means of less cutting, and consequently less expence. Under the beds of sand and clay that thus lie alternately together, and almost parallel to one another, is found a general body of impervious clay, that keeps up the water contained in the sand, which continues always full, moistening the adjacent clay, and, in wet seasons, running over it. As this *main under-stratum* of clay is seldom above four or five feet below the surface, a drain must be cut to that depth through the middle of the field, if it have a descent from both sides; or, if the ground declines all to one side, the drain must be cut there, where the water will more easily discharge itself into it; and, unless the field is of a considerable extent, and have more hollows in it than one, one drain will answer the purpose effectually; for, by crossing all the different beds that hold the water, it will draw it from each.

The great difficulty, however, in draining lands of this description, and which is impracticable by one drain, is, if the direction of the alternate beds of clay and sand lie *across* the declivity of the grounds; so that one drain, in this case, can have no other effect than that of carrying off the water after it has passed over the different strata, and would here naturally stagnate in the lowest part of the field, if there was no other outlet for it: therefore, when the ground lies in this manner, which is often the case, besides the drain in the hollow, others must be cut up from it, in a sloping direction, *across* the declivity, which by crossing all the different veins, or the very thin and narrow strata of sand, will extract the water from each. Where these alternate strata are of great extent, and the wetness produced by greater springs forming swamps at different levels on the side of the hills, the method of draining them has been already described.

The first thing to be observed, in the drainage of such alternate soils, is to discover minutely the inclination of the alternate strata, or how they lie with regard to the situation of the field to be drained, as upon this the direction of the drain entirely depends; and as the external signs that distinguish the different beds are easily perceptible, from the appearance of the surface, and difference of the herbage that each produces, there is little difficulty in attaining this part of the object. In drains of this kind there is seldom any need for applying the auger, as the necessary depth of the trench reaches far enough down; and as there is no spring for want of connection with the higher ground to force itself up through the auger-holes, or, if there is, it cannot, at so great a depth, and below such a body of clay, do any injury to the ground above.

The drain, after being formed like a fough at the bottom, or set like a triangle, must be filled a considerable way up with small stones, before the mould is thrown in, taking care

to have *tough* fods laid immediately above the former. Where stones are scarce, and plenty of brush-wood at hand, faggots may be substituted in their place with propriety. The under part of the drain, however, should be laid or *coupled* with stones, as a canal to carry off the water subsiding through the faggots; and which has also the good effect of prolonging their duration; for when the water cannot get off, which must be the case where there is no open conduit of stones, its stagnation amongst the branches must soon cause their decay, and choke up the passage of the drain. In no case whatever should the drain be filled with stones thrown in in a promiscuous manner, without a course for the water at the bottom being first formed. There is one thing more to be attended to in completely accomplishing the drainage of these soils: if the field lies very much on the descent, care must be taken in laying out the *branch*-drains in a direction sufficiently horizontal, so as not to make the fall too precipitant, by which the bottom of the trenches would be worn uneven, and this would obstruct the passage of the water, which might soon blow them up; but the fall should be such as to enable the water to clear its course. The reason why fewer drains are required in fields that lie nearly horizontal, as those of the second kind here mentioned, is, that the water is drawn equally from both sides, whereas those on a sloping declivity, drawing only from the higher sides of the drains, require them to be more in number, or closer to one another. This is the case in every situation where surface-draining is necessary, and particularly so in some sorts of soils, as will be seen described in that kind of draining. See *SURFACE-Draining*.

In Lancashire, where these soils, composed of alternate beds of clay and sand, very much predominate, and which have there acquired the names of *sand-pots*, or *guts*, a term properly enough applied to them from their holding water like a pot, it is observed, that several drainages have been executed by Mr. Elkington in the manner here described, and also a very difficult one of the same kind at Sutton-Hall, Derbyshire, where the water was contained in small beds of rock, crossed and intercepted by beds of clay.

There are still other cases of these intermixed soils, such as those which have a porous, or partly impervious superficial soil, while the under-strata are constituted of different distinct masses of impervious repellent materials, disposed in a regular manner. The lands which lie near the bottoms of hills and slopes are often composed of such impervious masses of the clayey, strong marly, or stiff loamy kinds. Such an intermixed, irregular construction of land, has naturally the effect of forcing the internal waters, which descend from springs in the higher grounds, as well as that which is taken up by the surface-soil, where it is porous, upwards towards the surface of the lands, or other directions, so as to cause or induce wetnesses which have different appearances, according to the nature or quality of the superficial parts of such grounds, as wet, rusty, feggy, or other cold moist lands, oozing, springy, wet lands, land-springs, quagmires, quicksands, and actual springs of water, either of the temporary or more permanent kinds, as the circumstances of the several cases may be.

The means of draining such intermixed portions of wet ground of this springy nature, although attended with some difficulty, is mostly capable of being accomplished without any very great trouble or expence: this is to be effected by cutting up from the main conducting drain, which should always be carried through the most depending masses, small drains into the separate upholding masses or strata, at suitable depths, so as to find the waters which rest upon them

and draw them off. Such drains, where properly made and directed, must not only be effectual, but durable in their nature. The bottoms of the drains or channels in all these cases should constantly be cut a few inches into the firm impervious beds or strata, and their higher sides be made to communicate well with the openings in which the waters are lodged. In these ways this sort of land may, in most instances, be rendered perfectly dry, and in a state fit for cultivation.

A full and perfect knowledge of the business of spring-draining is of the utmost utility and importance; as more labour and money have, probably, been uselessly thrown away upon this sort of rural improvement than that of any other, merely for want of such information. In many cases, from three to five times as much money may have been expended, and trouble caused, as the nature and circumstances of the different cases demanded. It is indeed not improbable, but that for one-fifth part of each, the business might, in different instances, have been more effectually and completely performed, if the person employed had been sufficiently informed on the subject. It has been the too common practice of the ordinary class of drainers, in removing the wetness caused by springs, whether from interest and design, or the want of adequate knowledge, to fill the ground with a number of drains, cut so as to spread and extend themselves in all directions, wherever the slightest appearances of moisture or wetness presented themselves; while in all probability, by the cutting of a single drain in a suitable and proper direction, so as to intercept the springs, or draw off the internally collected waters, which caused such wetness by their spreading branches, the whole of the land might at once have been effectually laid dry. The prevention of this useless waste of labour and money is only, perhaps, to be found in the endeavour to bring the nature of the theory and practice of this sort of draining into a more clear and comprehensive point of view, somewhat in the manner which has been attempted above, so as to enable those who undertake this kind of business, to superintend and direct all the various operations and processes of it in the most suitable, proper, and efficient manner, without incurring unnecessary expence. There can be no doubt that improvements of this principal kind in land would be much more generally attended to and extended than they are at present, if this were the case, and the ineffectual modes in which they are executed, in too many different instances, less frequent. As the chief and best skill of the artist, in this sort of business, probably lies in the readiness and certainty with which he is capable of discovering the main springs, collections, and passages or channels of the water which produce the different kinds of wetness which are to be removed; and as neither long custom, nor the most extensive practice, has hitherto been sufficient to lead to the means of attaining these, in all cases, even when guided and assisted by the outward superficial appearances which the surface of the ground may afford; it is somewhat extraordinary that other aids and methods have not been had recourse to for the purpose. This has, however, so far as we know, not been at all attempted until lately, and yet in one or two instances only. The ingenious drainer of Trafford-moors, in Lancashire, as already noticed, has contrived a pump for this use, which is to be put down into the soil in different places, in order to ascertain the presence of springs, or collections of water in it, before the work of draining is begun. It is an implement of very simple construction, and ready application, and which may be of very great utility in this intention. See *SPRING-Draining Pump*.

The writer of the work on "Landed Property" has also

suggested, that the borer is a tool which particularly presents itself as useful in this way. On the supposed similarity of the modes of searching for springs or internal waters, and for mineral or fossile substances, it is thought extraordinary that the same method of proceeding should not have long since been adopted. In the latter cases, in fresh districts, the work of searching for coal is not, it is said, begun by sinking a shaft, though appearances may be ever so favourable; the ground is first tried by the borer, at a comparatively trifling expence, to ascertain the proper place of sinking the pit. In trying for other matters, as ochres and other similar kinds, the same tool too may be said to be that which is in common use. And there can, it is thought, be no risk in saying, that it may be equally well and more profitably employed, as a common tool of the drainer, for the purpose of *finding* the springs, reservoirs, and channels of subterraneous waters, in the practice of that art, and by which it may be rescued from the difficulty and mystery in which it has hitherto been so greatly involved. See *BORER*.

It is stated, that an instance in the practice of a first-rate drainer has been seen, in which the use of the borer, for the purpose of *finding* the water before the spade was set to work, would have saved a large sum of money, which had been laid out under an error in the mode of practice which had been pursued.

There will be some difference in the depth and manner of using the tool, according to the circumstances and disposition of the land, and the intentions and methods of the draining which are to be undertaken, as has been shewn already in considering the nature of the drainage in different cases. And it may be necessary and convenient to have the bores and boring rods properly marked and regulated, especially in particular cases.

Thus, though there may be some instances of wetness in lands, in which it may be easy at once to judge and determine, with a great degree of certainty, of the nature and situation of the causes by which they are produced, and consequently to operate and perform the means of their removal without any difficulty or trouble of this sort; there are still numerous others, in which the use of such tools and implements may be of the highest and most material importance and advantage, not only in pointing out, with accuracy, the peculiarity of their situations and directions, but in preventing uncertainty and unnecessary cutting, and thereby procuring considerable savings in different ways. They must, of course, contribute much to render the practice of spring-draining more complete and perfect.

SPRING-Draining Auger, that sort of tool which is employed in this kind of draining for boring down into the substrata of the earth, after the drains have been dug, and tapping or letting off the springs, or for perforating the stiff soil or other parts, and letting the water down into a porous stratum below. It is a tool of very great utility in this sort of draining, and which has much similarity to that which is employed in searching for coal and other subterraneous minerals. The auger, or shell part that forms the hole or bore in the earth or strata through which it passes, is mostly from about two and a half to three inches in diameter; the hollow portion of it being about one foot four inches in length, and constructed nearly in the form of the common auger of the carpenter, only the sides of the shell part are made to come closer to each other. The rod parts are formed in separate pieces, of four feet long each, which screw into one another, to any suitable length, one after another, as the depth of the hole or bore may require. The size of the stem above the auger part is about an inch square, except

SPRING.

except at the joints, where, for the sake of strength, they are a quarter of an inch more. There are also a chissel and punch for serewing on, in going through hard gravel, or metallic substances, in order to expedite the passage of the auger, which could not otherwise perforate such hard bodies. The punch is often used, when the auger is not applied, to prick or open the sand or gravel, and give a more easy issue or discharge to the water. The chissel is an inch and a half or two inches broad at the point, and made very sharp for cutting stone, and the punch an inch square, like the other part of the rods, with the point sharpened also. There is a shifting handle of wood, which is fattened with two iron wedges affixed to it, for the purpose of turning round the rods in boring, and also two iron keys for serewing and un-serewing the rods, and for assisting the handle when the soil is very stiff, more than two men being required to turn the tool.

It is remarked by Mr. Elkington, that it has been considered a difficult part of the business of draining, to judge properly when to make use of this boring tool. Some, it is said, who have not seen it employed in this sort of work, have been led into a mistaken notion, both as to the manner of using it, and the purposes for which it is applied. They think, that if, by boring indiscriminately through the ground to be drained, water be found near enough the surface to be reached by the depth of the drain, the proper direction for it is along those holes where water has been found; and thus make it the first implement that is used. The contrary is the case, the auger being never made use of until after the drain is cut, and then for the purpose of perforating any retentive or impervious stratum lying between the bottom of the drain and the reservoir or strata containing the spring. Thus it is capable of greatly lessening the trouble and expence that would otherwise be requisite in cutting the trench to that depth, to which, in many instances, the level of the outlet will not admit. See *SPRING-Draining*.

The manner of using the tool in working of it is simply thus: two or rather three men are necessary. Two stand above on each side of the drain, who turn it round by means of the wooden handle; and when the auger part is full they draw it up out of the hole, and the man in the bottom of the trench clears out the earth with the instrument for the purpose, assists in pulling the auger up out of the hole, and in directing it into it again, and can also assist in turning with the iron handle or key, when the depth and length of the rods require additional force to perform the operation. The workman should be careful in boring, not to go deeper at a time, without drawing, than the exact length of the shell, otherwise the earth, clay, or sand, through which it is boring, after the shell is full, may make it very difficult to pull out. For this purpose the exact length of the shell should be regularly marked out on the rods, from the bottom upwards. Two or four flat boards, with a hole cut into the side of one of them, and laid alongside of one another over the drain, in the time of boring, are of very great use for directing the rods in going down perpendicularly, for keeping them steady in boring, and for the men standing upon, when performing the operations.

The *horizontal* draining auger is another tool of this kind, which was invented in Leicestershire, and is probably not yet become well known, or in general use. It is capable, however, of having considerable utility and application in the practice of spring-draining, as well as in other ways. It has the advantages, in many cases, of greatly lessening the expence of cutting, that would otherwise be necessary, and of performing the work in a much shorter space of time. It may be of great benefit when employed for forming a

suitable passage for the water without opening a trench-drain, where the water of a drain, brook, or rivulet has to pass under a bank, hedge, road, wall, or any other similar place, and where pits are to be laid dry; as well as in many other cases, as for tapping springs, or detecting water at the bottom parts of hilly lands, in order to the draining of the ground or the supplying of the water for different useful purposes, as the water of the springs, in these cases, when it may be hit upon, will flow with more facility and readiness, as well as in greater abundance, through such horizontal or level openings, than through perpendicular outlets. It may likewise be useful for laying or putting down leaden pipes for the passage or conveyance of water, in making the holes into which the pipes may be introduced, and laid without the necessity of forming open cuts for the purpose, which are often very laborious and troublesome in performing.

The manner of using the tool in working is this: where, for instance, water is to be discharged from any situation in which it is contained, that has high banks surrounding it, if the land declines lower on one side, after finding the level of the bottom of the water on that side, it is to be traced to the face of the bank, where the perforation is to be made through it by the auger. In doing which, the surface of the ground is there first to be made smooth, so as to place the frame of the tool nearly level, with the auger part of it pointing a little upwards. It is then to be wrought, which is done by two men turning the handles at the top part. When the auger or shell part is full, the rods are drawn back by reversing the lower handle, and other rods may be added at the joints when the distance requires it. In boring or working through a bank composed of the hardest clay, or other such materials, two men will, for the most part, get through from thirty to forty feet in the course of a day, if they be not obstructed by hard stones, or other such matters, which will require a chissel to be fixed on in the tool in the place of the shell, and longer time in working through. Where the length or distance to be bored or wrought through is considerable, and longer than the whole length of the different rods when serewed together, a pit or opening is necessary to be dug or sunk down, at a suitable distance, upon the line to the proper depth of the hole, for placing the frame and tool in when removed from its former place, and the work be then carried on in the same manner as before in the former part of the operation.

SPRING-Draining Level, that sort of level which is employed in forming and cutting drains where springs are concerned. It is the spirit-level which is, for the most part, made use of in cases of this sort, and which serves to ascertain, after a principal spring has been discovered, a line on the same level, to only one, or the different sides of it, in order that the direction of the drain may be better and more certain. The use of it is mostly the first and most important work in setting out drains in this sort of drainage. It is employed in determining the level from one particular sight, or from different stations, for a considerable length or distance. It is also necessary to decide the quantity of fall that can be gained from a drain to the nearest outfall or outlet for the discharge of the water, as the more short that is the better, when sufficient fall can be had. It has likewise several other applications in the practice of spring-draining, as may be seen in speaking of implements or contrivances of this nature. See *LEVEL*.

Scarcely any thing can be done, in this or any other mode of draining, nor even in irrigating or watering land, without the use of a proper level of some kind or other.

SPRING-Draining Pump, that sort of contrivance of the pump kind, which is made use of for the purpose of detect-
ing

ing and ascertaining the nature, situation, and direction of under-ground springs and collections of water, as well as, in some measure, the nature and position of the different strata in land, before the work of cutting and forming the drains for taking off the injurious wetness is begun. It is constructed of copper, in the pipe form, in a very neat, simple, and cheap manner, so as to admit of being put down into the ground in holes formed by the boring-auger; and by being made to be wrought as a pump, is capable of shewing the presence of water, where the pressure of it in the higher grounds above is not sufficient to force it up through the auger-holes, which is the case in many instances. The nature and direction of the under-strata are, in some degree, found in boring and putting the pump down through them. It is the invention and discovery of Mr. Wakefield, who has been long much engaged in the practice of draining in several different places and parts of the kingdom. See *SPRING-Draining*.

This is a contrivance which, with the boring-rod, would seem to be capable of being of very great importance in the business of spring-draining, as tending, by the facility and certainty which it affords of discovering and pointing out the nature, existence, and lines of springs, before any thing is done, to prevent a great deal of unnecessary labour in cutting at random, as has hitherto mostly been the case, and thereby save much useless expence to those who are under the necessity of having such works performed. The utility of these contrivances is more fully shewn under the head alluded to above.

SPRING-Draining Bricks, the several different kinds, forms, and shapes of bricks which are contrived for this use, and which differ from those of the common sort employed in building purposes. They are of many different descriptions. These kinds of bricks are mostly well calculated for forming drains which are to carry off the water coming from springs, as a large extent of land may often be rendered dry by no very great quantity of such materials; but they are not so well suited for drains which are to remove water which stagnates on the surface of land, though they are occasionally made use of for that purpose. They sometimes form hollow passages for the water to run along, as in stiff soils; but in such as are soft they are made to form a sort of pipe or cylindrical passage for the same, by being laid one upon the other. See *SPRING-Drain*.

SPRING-Bog, a term applied to that sort of bog or boggy wetness which is caused by springs, in contradistinction to that, or the swampy wetness, which proceeds from the stagnation of rain or other water upon the surface of land where these prevail in land-locked situations.

Spring-bogs are, for the most part, more confined than those of the contrary kind, but they are sometimes equally extensive with them.

SPRING-Brine. See *SALT-Brine Spring*.

SPRING, Elater, in *Physics*, denotes a natural faculty, or endeavour, of certain bodies to return to their first state, after having been violently put out of the same by compressing, bending them, or the like.

This faculty philosophers usually call *elastic force*, or *elasticity*.

Fleas only jump to excessive heights by means of a springy membrane, easily visible by a microscope; and of which we have a curious figure in Dr. Hooke's *Micrographia*. By the elastic force of this spring they are enabled to leap two hundred times the height of their own body. See *FLEA*.

Nature has provided for the regular sowing of the seeds of several kinds of plants, by furnishing them with a spring,

which is wound sometimes round the outside, and sometimes round the inside of the case in which the seeds are contained. See *SEMINATION*.

SPRING, in *Mechanics*, is any elastic body, commonly of steel properly tempered, and formed in various ways, according to the purpose it is intended to answer, whether it be for giving motion to a machine, or for equalizing and modifying motion derived from some other agent. Springs are also introduced into instruments, called spring steel-yards, for ascertaining the weights of bodies, as well as having various other applications, which it would be useless to enumerate in this place.

Considering, therefore, the numerous uses to which this kind of force may be directed, it must appear very remarkable that so little is known of the true principle of the action of springs, and of the laws by which their powers are regulated; we know, indeed, of no regular set of experiments, that have yet been made, which are at all adequate to reducing their operation to correct mathematical principles.

Dr. Hooke seems to have been the first writer who undertook experiments on the action of springs, with a view of drawing from them general conclusions, and by this means to introduce them into the theory of rational mechanics: and the result which he thus obtained, was his celebrated law "ut tensio sic vis," the tension is as the force: a law which some subsequent experimenters have stated to be correct, while others of considerable eminence have denied its accuracy and agreement with experiment in numerous cases. The fact, therefore, seems to be, that in springs of a certain form, and *within certain limits*, the principle is just; but that others of different form, and in *all*, when the force is very considerable in regard to the strength of the spring, it does not apply: and, consequently, that much still remains to be done before the actions of different springs can be admitted to form a part of theoretical mechanics.

Dr. Jurin, by adopting the principle above referred to, *viz.* "the tension is as the force," succeeded in rendering the action of springs susceptible of mathematical computation. See *Phil. Trans.* N^o 472. p. 46; or vol. ix. p. 19. of *Hutton's Abridgment*.

This paper certainly displays great ingenuity, and would be of considerable utility, provided the hypothesis there assumed were perfectly correct; and even as it is, although a different law may have place between the space through which the spring is drawn or compressed, and its resistance, the same principle of investigation must still be preferred; and it may, therefore, be considered as the foundation on which the true theory must be raised, after a sufficient number of experiments has been made to assure us of the correct law of their action, not merely within the narrow limits contemplated by the founder of the hypothesis, but through all degrees of compression and extension, short of that which destroys their original elasticity. We shall therefore offer no apology for exhibiting a concise view of the principal theorems and deductions of this ingenious author.

Dr. Jurin commences his memoir with a few necessary definitions; as the

Length of a spring, which is used to signify the greatest length to which a spring can be forced inwards, or drawn outwards, without prejudice to its elasticity. He observes, this would be the whole length, were the spring considered as a mathematical line; but in a material spring, it is the difference between the whole length, when the spring is in its natural situation, or the situation it will rest in when not disturbed by any external force, and the length or space it takes

SPRING.

takes up when wholly compressed and closed, or when drawn out.

Strength or force of a spring is used for the least force or weight which, when the spring is wholly compressed or closed, will restrain it from unbending itself. Hence also the force of a spring bent, or partly closed, is used for the least force or weight which, when the spring is bent through any space less than its whole length, will confine it to the state it is then in, without suffering it to unbend any farther.

We have before stated, that the principle which this author assumes is, that if a spring be either compressed or stretched by any external force, its resistance is proportional to the space by which it is removed from its original and natural situation. Thus, suppose, for instance, a spring (*Plate XXXVIII. Mechanics, fig. 6.*) CL , resting with the end, L , against any moveable support, but otherwise lying in its natural situation, and at full liberty; then, if this spring be pressed inwards by any force, p , or from C towards L , through the space of one inch, and can be there detained by that force, p , the resistance of the spring and the force, p , exactly counterbalancing one another; then will the force $2p$ bend the spring through the space of two inches, $3p$ through three inches, $4p$ through four inches, &c. The space, Cl , (*fig. 7.*) through which the spring is bent, or by which its end, C , is removed from its natural situation, being always proportional to the force which will bend it so far, and will detain it so bent.

And if one end, L , be fastened to an immoveable support (*fig. 8.*), and the other end, C , be drawn outwards to l , and be there detained from returning back by any force, p , the space, Cl , through which it is so drawn outwards, will be always proportional to the force, p , which is able to detain it in that situation.

And the same principle holds in all cases, where the spring is of any form whatsoever, and is in any manner whatsoever forcibly removed from its natural situation.

It may be here observed, that the spring, or elastic force of the air, is a power of a different nature, and governed by different laws from that of a material spring. For supposing the line LC (*fig. 6.*) to represent a cylindrical volume of air, which by compression is reduced to Ll (*fig. 7.*), or by dilatation is extended to Ll (*fig. 8.*), its elastic force will be reciprocally as Ll ; whereas the force or resistance of a spring will be directly as Cl .

This principle being premised, Dr. Jurin gives us a general theorem concerning the action of a body striking on one end of a spring, while the other end is supposed to rest against an immoveable support. And lest any objection should be formed against the possibility of an immoveable support, since any body, how great soever, may be removed out of its place by the least force, he observes, that the objection may be easily removed. Thus, if the spring LM (*fig. 9.*) be supposed continued to N , so that $LN = LM$, if a body M , with any velocity in the direction ML , strikes one end of the spring, and a body N , at the same time, with an equal velocity, and a contrary direction NL , strikes the other end, N , of the continued spring, the point L , the end of the first supposed spring, will be immoveable.

Theorem.—If a spring of the strength P , and the length CL (*fig. 10.*), lying at full liberty on an horizontal plane, rest with one end, L , against an immoveable support; and a body of the weight M , moving with the velocity V , in the direction of the axis of the spring, strike directly on the other end, C , and thereby force the spring inwards,

or bend it through any space CB ; and a mean propor-

tional, CG , be taken between the line $CL \times \frac{M}{P}$, and

$2a$, a being the height to which a heavy body would ascend in vacuo, with the velocity V ; and upon the radius $R = CG$, be erected the quadrant of a circle GFA : then,

1. When the spring is bent through any right sine of that quadrant, as CB , the velocity, v , of the body, M , is to the original velocity, V , as the cosine to the radius;

$$\text{that is, } v = V \times \frac{BF}{R}.$$

2. The time, t , of bending the spring through the same sine CB , is to T , the time of a heavy body's ascending in vacuo with the velocity V , as the corresponding arc to

$$2a; \text{ that is, } t = T \times \frac{GF}{2a}.$$

After demonstrating this proposition, the author proceeds to draw from it several curious corollaries, which, for greater simplicity, he divides into three distinct classes, according as they appertain to the following cases: *viz.*

Case 1.—When the spring is bent through its whole length, or is entirely compressed or closed, before the moving force of the body is destroyed and its motion ceases.

Case 2.—When the moving force of the body is consumed, and its motion ceases before the spring is bent through its whole length, or wholly closed. And

Case 3.—When the moving force of the body is expanded, and its motion ceases at the instant that the spring is bent through its whole length, and is entirely closed.

We shall enumerate a few of the most interesting corollaries in each of these classes, premising first, that P = strength of the spring, L = its length, V = the initial velocity of the body closing the spring, M = its mass, t = time spent by the body in closing the spring, A = height from which a heavy body will fall in vacuo in a second of time, a = the height to which a body would ascend in vacuo with the velocity V , C = the velocity gained by the fall, m = the circumference of a circle, whose diameter is 1.

CASE 1. Cor.—When the spring is bent through any right sine, CB , (*fig. 10.*) the loss of velocity is to the original velocity, as the versed sine to the radius; or $V -$

$v = V \times \frac{Gg}{R}$, where v is the present, and V the original velocity.

2. When the spring is bent through any sine, CB , the diminution of the square of the velocity is to the square of the original velocity, as the square of the sine to the square

$$\text{of the radius; that is, } V^2 - v^2 = V^2 \times \frac{CB^2}{R^2}.$$

3. When the spring is bent through any space, l , the velocity, v , of the body is equal to $V \times \sqrt{\frac{2MLa - Pl^2}{2MLa}}$;

$$\text{or to } V \times \sqrt{\frac{2Ma - pl}{2Ma}}.$$

4. The time, t , of bending the spring through any space, l , is proportional to the arc, GF , divided by \sqrt{a} ; l being

l being the right sine of the arc, and $R = \frac{2MLa}{P}$ being the radius.

CASE 2. Cor. 1.—If the motion of the body cease when the spring is bent through any space, l , the initial velocity is

$$V = Cl \sqrt{\frac{P}{2MLA}}, \text{ or } V = C \sqrt{\frac{pl}{2MA}}.$$

2. If the motion of the body cease when the spring is bent through any space l , the time, t , of bending it is

$$t = 1'' \times \frac{m}{2} \sqrt{\frac{ML}{2PA}}, \text{ or } t = 1'' \times \frac{m}{2} \sqrt{\frac{Ml}{2pA}},$$

where $m = 3.1416$, viz. the circumference of a circle to diameter 1.

3. In the same case, the time of bending the spring is proportional to $\sqrt{\frac{ML}{P}}$, or to $\sqrt{\frac{Ml}{p}}$; and if $\frac{L}{P}$ be given, t will be as \sqrt{M} ; and if both $\frac{L}{P}$ and M be given,

t will always be the same, whatever be the original velocity, or through whatever space the spring is bent.

4. If the motion of the body cease when the spring is bent through any space, l , the product of the initial velocity, and the time of bending the spring, or Vt , = $1'' \times \frac{mCl}{4A}$, and is proportional to l , the space through which the spring is bent.

Hence, any two of the three quantities, V , t , and l , being given, the other is readily determined.

5. In the same case the initial quantity of motion MV = $C \sqrt{\frac{PM}{2LA}}$, or $MV = C \sqrt{\frac{plM}{2A}}$.

CASE 3. Cor. 1.—If the motion of the body striking the spring cease, when it is wholly closed, the initial velocity

$$V = C \sqrt{\frac{PL}{2MA}}.$$

2. The initial velocity V is proportional to $\sqrt{\frac{PL}{M}}$.

3. If PL be given, either in the same or in different springs, the initial velocity V is reciprocally as \sqrt{M} .

4. The product of the initial velocity, and the time spent in closing the spring, or Vt , = $1'' \times \frac{mCL}{4A}$; and is proportional to L , the length of the spring.

5. The initial quantity of motion, or MV , = $C \sqrt{\frac{PLM}{2A}}$.

6. MV is proportional to \sqrt{PLM} , or to Pt . And if PL be given, either in the same or different springs, MV is as \sqrt{M} .

7. If $\frac{P}{L}$ be given, either in the same or in different springs, the initial quantity of motion is as the length of the spring into the time of bending it.

8. If a quantity of motion, MV , bend a spring through its whole length, and be consumed by it, no

other quantity of motion equal to the former, as $\pi M \times \frac{V}{n}$, will close the same spring, and be wholly consumed by it.

9. But a quantity of motion, less or greater than MV , in any given ratio, may close the same spring, and be wholly consumed in closing it; and the time spent in closing the spring will be respectively less or greater, in the same given ratio.

10. The initial *vis viva*, or MV^2 , = $\frac{C^2 PL}{2A}$; and $2aM = PL$.

11. The initial *vis viva* is as the rectangle under the strength and length of the spring: that is, MV^2 is as PL .

12. If $\frac{P}{L}$ be given, the initial *vis viva* is as P^2 , or as L^2 .

13. If the *vis viva* MV^2 bend a spring through its whole length, and be consumed in closing it; any other *vis viva*, equal to the former, as $n^2 M \times \frac{V^2}{n^2}$, will close the same

spring and be consumed by it.

14. But the time of closing the spring by this *vis viva* $n^2 M \times \frac{V^2}{n^2}$, will be to the time of closing it by the *vis viva* MV^2 , as n to 1.

15. If the *vis viva* MV^2 be wholly consumed in closing a spring of the strength P , and length L ; then the *vis viva* $n^2 MV^2$ will be sufficient to close, 1, either a spring of the strength $n^2 P$, and length L ; 2, or a spring of the strength $n P$, and length $n L$; 3, or of the strength P , and length $n^2 L$; 4, or if n be a whole number, the number n^2 of springs, each of the strength P , and length L , one after another. We may add, that it appears from hence, that the number of similar and equal springs a given body in motion can wholly close, is always proportional to the squares of the velocity of that body. And it is from this principle that the chief argument, to prove the force of a body in motion to be as the square of its velocity, is deduced. See FORCE.

The theorem above-mentioned, and its corollaries, will hold equally, if the spring be supposed to have been at first bent through a certain space, and by unbending itself to press upon a body at rest, and thereby to drive that body before it, during the time of its expansion: only V , instead of being the initial velocity with which the body struck the spring, will now be the final velocity with which the body parts from the spring, when totally expanded.

It is also to be observed, that the theorem, &c. will hold equally good, if the spring, instead of being pressed inwards, be drawn outwards by the action of the body. The like may be said, if the spring be supposed to have been already drawn outwards to a certain length, and in restoring itself draw the body after it. And, lastly, the theorem extends to a spring of any form whatever, provided L be the greatest length it can be extended to from its natural situation, and P the force which will confine it to that length. See Phil. Trans. N^o 472. sect. 10. or vol. xliii. art. 10.

SPRING is more particularly used, in the *Mechanic Arts*, for a piece of tempered steel, put into several machines to give

give them motion, by the endeavour it makes to unbend itself.

In watches it is a fine piece of well-beaten steel, coiled up in a cylindrical case, or frame; which, by stretching itself forth, puts the wheels, and the whole movement, in motion. See FUSEE, and WATCH.

The spring of a watch is prepared by forming a very thin plate of steel into a double ring, bending it round with wire, and putting it into a proper furnace, in order to give it a suitable degree of heat. When that is acquired, it is taken out, and dropped into a kettle of oil, or warm mutton suet, in consequence of which process it possesses a degree of hardness, very little inferior to that of glass. After this it is reduced or let down, if the steel be of a proper kind for the purpose, to a fine violet or blue colour; in which state it becomes exceedingly elastic, inasmuch, that to make it stand bent, it must be brought into a very acute curve; nor can it easily be brought, by twisting horizontally, to alter its form, without endangering its being broken to pieces. But as it afterwards requires to be planished by the hammer, filed, and polished, it is again deprived in a considerable degree of its elasticity: and, therefore, when it has received its last polish, it must again be blued upon a brass plate over a lamp, by which means its former elasticity is perfectly restored. Dr. Hooke, in his *Micrographia*, says, that this blue covering is owing to the fine sulphur, pressed through the pores by heat, and fixed by the ambient air in a fine vitrified lamina upon the surface. See STEEL.

The spring of a lock, pistol, or the like, is a piece of steel violently bent, which beats back the bolt, or strikes down the cock, when set at liberty.

SPRING-*Arbor*, in a *Watch*, that part in the middle of the spring-box, about which the spring is wound or turned, and to which it is hooked at one end.

SPRING-*Box*, the cylindrical case, or frame, that contains within it the spring of the watch.

SPRING-*Compasses*. See COMPASSES.

SPRING-*Rings*, in *Rural Economy*, the large ring contrivances of the strong spring kind, through which the reins pass in stables, in order to prevent horses from being injured by being entangled in them. They have a different form from the rings which are commonly employed, and are fixed in an immoveable manner to the items, shanks, or parts, which screw into the wood and hold them fast. The springs in them are so contrived, as that the reins of the head-stalls can be slipped into and out of them with great ease and facility. They are a very useful and safe sort of ring contrivance, for this purpose, in many cases, especially where horses are restless, and much liable to the above kind of accidents. The expence of them is not great, while the security which they may afford is considerable. They are equally necessary and beneficial in farm stables as those of the saddle-horse kind. See STABLE *Rings for Stalls*.

SPRING of the *Air*, or its elastic force. See AIR and ELASTICITY.

SPRING, in a *Ship*, is a rope passed out of one extremity of a ship, and attached to a cable proceeding from the other, when she lies at anchor. It is usually performed to bring the ship's broadside, or battery of cannon, to bear upon some distant object: as another ship, or a fortress on the coast, &c.

SPRING is likewise a rope reaching diagonally from the stern of a ship to the head of another, which lies alongside or abreast of her, at a short distance. This is generally performed to make one of the ships sheer off to a greater distance from the other; or to make merchant-ships lie uni-

formly in the same tier. Springs of this sort are, therefore, occasionally applied from a ship to a wharf or key, for the same purpose. Falconer.

SPRING a *Leak, To*. See LEAK.

SPRING the *Luff, To*. See LOOF.

SPRING a *Mast*. See MAST.

SPRING, *To*, in *Military Language*, is to give vent to any combustible matter upon which gunpowder principally acts by the power of explosion. Hence the phrase to spring globes of compression, &c. which are frequently used for the same purposes with sky-rockets, &c. to serve as signals when any sudden attack is to be made.

SPRING, *To*, is also to step forward with a certain degree of elasticity.

SPRING the *Firelock, To*, is to bring it briskly up to any ordered position, *c. g.* in the recover.

SPRING *Up*, a word of command occasionally used, and signifying the same as double up; sometimes used singly, as *spring!* particularly to light infantry men.

SPRING, *Cear*. The cear is a piece of hardened iron or steel in a gun-lock, which moves on a pivot, and the point of which is received in a notch cut in the tumbler, and the other end is acted upon by the trigger. The cear spring is a small spring, which throws the cear into the said notch, when the piece is at half cock or full cock.

SPRING, *Feather*, the spring of a gun-lock beneath the foot of the hammer, called likewise hammer-spring.

SPRING, *Main*, the spring of a gun-lock, which operates on the tumbler, and gives force to the cock.

SPRING, *Ver*, in *Cosmography*, denotes one of the seasons of the year; commencing, in the northern parts of the world, on the day the sun enters the first degree of Aries, which is about the twenty-first day of March, and ending when the sun leaves Gemini.

Or, more strictly and generally, the spring begins on the day when the distance of the sun's meridian altitude from the zenith, being on the increasing hand, is at a medium between the greatest and least. The end of the spring coincides with the beginning of summer.

Spring is the season in which plants vegetate and grow with the most force and luxuriance. Late springs are, however, in general, the most beneficial to the farmer, and occasionally to the gardener.

In such springs as are late in their appearance, there is, for the most part, less danger in the climate of this country of the crops of different kinds suffering from the checks and injuries which they may receive in them, than in those which are early, as the changes in them are mostly much less frequent, and at the same time much less severe.

Fruit-trees of various kinds are often greatly injured in the formation and production of their fruit by early springs. This is particularly the case with the almond, the apple, the plum, and the cherry-tree, as well as with the gooseberry-bush, and some others. The peach, the nectarine, and some other fine fruited trees, are also sometimes much injured in their fruiting by early springs, as where they are planted against walls or palings, in the open ground in exposed situations.

Garden-crops of many different kinds not unfrequently suffer greatly from early springs; whole crops of particular sorts being, in some instances, nearly destroyed, as is not seldom the case, in such seasons, in the first sown onion, pea, and several other kinds of culinary crops.

SPRING *Crops*, in *Agriculture*, such as are put into the ground in the spring season of the year, as oats, barley, some sorts of wheat, and different other crops. See these heads.

SPRING *Food*, that sort of food, whether of the turnip,

rye, tare, rape, cabbage, preserved grafs, artificial grafs, natural grafs, or any other kind, which is made use of for live-stock, especially sheep, in the spring season.

SPRING Garden, that sort of ornamental garden which is chiefly designed for the introduction of all sorts of curious early budding and flowering trees, shrubs, and flower-plants, in the intention of affording beauty, variety, and effect.

Gardens of this nature should be suitably situated somewhat contiguous to those of the winter kind, being connected with them and the residences by suitable walks of the gravel kind, so as that they may be gone into at any season or period without inconvenience. The ground or soil for them should be of the more light, friable, and dry kind, and be so situated as to be well exposed to the influence of the sun, being completely sheltered on the northern sides, so as to prevent the blasts from that quarter having any injurious effects on them. They should also have some sort of neat ornamental erection in them for containing the heaths, the auriculas, and different other tender early flowering plants.

Gardens of this sort have a fine effect in many situations, when well laid out and managed. See **PARTERRE**.

SPRING Grafs, a term sometimes applied to the sweet-scented vernal or meadow-grafs, from its being so forward or early in its growth. See **ANTHOXANTHUM odoratum**.

It also signifies the grafs of any kind that springs early in the spring season, and which affords the first bite for live-stock of any sort.

SPRING Sowing, such sowings as are performed in the spring season, as that for spring wheat, oats, barley, and many other crops. See **SOWING of Seeds**.

SPRING Sowing, in **Gardening**, comprehends all those sowings which are made at that season of the year, especially for any sort of general feed crops, as those of the pea, bean, and small seed kinds. Small flower and other seeds are put into the ground at an early period with advantage, as they are much less liable to be injured by insects in their after-growth, and rise more favourably than where the contrary is the case. The same is sometimes the case with small grafs seeds sown in the field. See **SOWING of Seeds**.

SPRING Tare, a term used to signify that sort of tender tare, which is sown and cultivated in the spring season for summer use, in contradistinction to the winter tare, which is usually sown in the autumn, and stands the severity of the winter season. See **TARE**.

SPRING Tide is the increasing of a tide after a dead neap; or the periodical excess of the elevation and depression of the tide; which see.

SPRING Wheat, that sort of this kind of grain, which is capable of being sown or put into the ground in the early spring season, and cultivated or grown with the same or greater success and advantage, than the common kind. It has been stated by sir Joseph Banks, that real spring wheat, the *tritium aestivum*, or summer wheat of the botanists, is a grain too tender to stand and bear the frosts of the winter in this climate, but as quick in its progress from its first shoot to ripeness, as barley, oats, or any other spring corn. See **TRITICUM**.

The writer of the tract on the result of an Inquiry into the nature and causes of the blight, the rust, and the mildew, which have affected the wheat-crops on the borders of England and Scotland, has suggested, that common or winter wheat requires the most expensive culture, being generally put into the ground in the autumn, and usually requiring eleven months before it arrives at maturity; that consequently the returns from such a species or sort of grain, should be more lucrative than when spring corn of this kind is raised, which, after remaining only about four

months in and on the ground, is then in a proper state to be cut down. Nor is the difference in point of produce supposed to be so very material, as to render it indispensably necessary to exclusively cultivate winter wheat, with a view to profit; and, indeed, it would appear, it is said, that in several other respects, it would be desirable to grow a considerable quantity of spring wheat in this kingdom, as being better calculated for the different soils and situations in different parts and places, as being less liable to disease, and as furnishing a most important resource in case there be reason to apprehend that the autumn or winter-sown wheats may become unproductive, or of a bad quality.

It is well known, that in some parts of the kingdom it is the practice to sow winter wheat in the spring, seldom, however, it is supposed, later than the month of February, or the middle of March, and have occasionally good crops from it; and it is understood, from the most respectable authority, that though the winter wheat sown in the spring is at first later in ripening than the same sort sown in autumn, yet that this disadvantage, in regard to becoming ripe, lessens, when the crop of wheat of that sort which was sown in the spring, is sown again in the succeeding spring. Winter wheat sown in spring thence acquires a tendency, it is said, to earlier maturity, if resown in the spring; but from an experiment which was tried in the county of Middlesex, it does not appear, that when sown in the autumn it becomes ripe earlier than common winter wheat. But still, it is admitted, that it does not ripen quite so soon as wheat sown in autumn, nor as real spring wheat, nor can it be sown so late in the season. An intelligent farmer, it is said, states the difference between real spring wheat and winter spring-sown wheat, at three weeks; which is a most material advantage in favour of the former. But as we have a species or sort of wheat which is peculiarly calculated for spring culture, why, it is asked, should we endeavour to force another sort to alter its nature and properties, and to grow and acquire maturity in a shorter period of time than nature intended? And if considerable quantities of wheat too can be sown in the spring, with perfect safety and success, why, it is also asked, should we confine our Lent or spring crops of grains to oats and barley? It is suggested, as being also understood by the same writer, on respectable authority, that the spring-sown wheats were, at one time, getting out of use or fashion in France; but that they were soon under the necessity of again returning to them as an essential source of supply.

In this place we may then shortly consider the history, nature, qualities, uses, and advantages of it, as well as the sorts of land and exposures most suited to its growth, and the means by which the seed of it may be the best and most readily procured; leaving the methods of its cultivation, growth, application, and other points and circumstances, to the head wheat, to which indeed they as well as it properly belong. See **WHEAT**.

Spring, or this sort of wheat, is supposed, and with great probability, to have been originally produced in Sicily, where it is known, it is said, under the name of *Tumenia*, a corruption of *Trimenia*, or three months' grain. It is also much cultivated in Barbary, in Spain, in Portugal, in France, in Germany, and in almost all the corn countries, with the exception of this country, where, on account of the immense consumption of malt-liquors, barley is more in demand, than where wine is the common beverage of the people. The former of the above writers considers it as well known over all parts of the continent of Europe, and to be much used and employed in cultivation in France, where it is called *Blé de Mars*, from the season in which it is usually sown; and in some provinces

provinces of that tract of country *Bleds-tremois*, from the time it takes between seed-time and harvest; that in Spain, it is called *Trigo de Marzo*; in Portugal, *Trigo Tremes*; and in Germany, *Sommer Weitzen*; according to the languages of the different countries; all of which names are said to mark in a distinct manner the difference between this and the winter corn of the same sort. It has also been asserted on the same authority, that spring wheat may be sown in autumn, and that if it should succeed, it will produce a beautiful sample, but that as it is, like barley, a tender plant, a severe frost will kill it. Some have, however, supposed it to be a native of some part of Tartary, but it is evidently the production of a warm climate, such as that noticed above. It has been classed by Ray, and probably others, as a distinct species or sort of wheat. In regard to its introduction into this country, it is commonly believed to have been introduced or brought into it about the year 1773, or probably a little earlier, under the names of Siberian wheat, Switzerland wheat, or blé de Mars, as above. It is said, however, to have been mentioned by Harrison, an historian in the time of Elizabeth, though he represents it as having been then only known to a few husbandmen or farmers.

It has also been said that spring wheat was known to the Romans as a species or sort distinct from the common autumn or winter kind, and described as such by Columella, who considered and believed it very acceptable to the farmer, when, in consequence of floods, rains, or other similar causes, the autumn or winter wheat was prevented from being sown or put into the ground by him. And that the Rev. Mr. Dickson, in his "Husbandry of the Ancients," has likewise considered it as well adapted to the wet cold climate of Scotland, where, on account of heavy rains, and other causes, the farmers are not unfrequently restricted in regard to the quantity of autumn or winter wheat that can be sown or got into the ground.

The writer first noticed has, however, remarked, that it does not appear from the older books on husbandry, that it was at any former period much grown or cultivated in this country; and that the more modern ones are in general silent on the subject of it: they mention, indeed, under the name of spring wheat, every kind of winter wheat which will ripen when sown after turnips in the month of February; but little or nothing is said on real spring wheat. This, it is conceived, is probably the reason why the real spring wheat has been so little known, the cultivators of land in general conceiving themselves to be actually in the habit of sowing spring wheat, when, in reality, they were only substituting winter wheat in its place, have been little inclined to inquire into the properties or qualities of the real spring wheat, when they had an opportunity and the means of so doing.

The inquirer already noticed states, on the authority of an intelligent correspondent, that above thirty years ago, the empress Catharine sent a bushel of spring wheat to his majesty, which the king gave to Mr. Duckett, the celebrated farmer of Esher, in the county of Surrey, who cultivated it for some time, and sold a number of bushels from it for seed. Notwithstanding which, not a vestige of it now, it is said, remains in all that neighbourhood. On which, it may be observed, that, as coming from Russia, it might not be the best sort of spring wheat, of which there are so many varieties, as will be seen below: that a small quantity, thus accidentally introduced into a district, might get into improper hands, and be given up from thoughtlessness or inattention: that the difference of price between wheat and barley, considering the difference of produce, was then so inconsiderable, as to induce farmers to give

up the culture, not only of spring, but even of winter wheat: and that the introduction of many other useful objects and practices, besides that of spring wheat, has at first many obstacles, difficulties, and impediments to contend with. The late Dr. Walker, in a work noticed below, has likewise observed that this sort of wheat, or the true *summer* wheat, as he calls it, is a grain very little known in this country, though much grown in the northern parts of France, as well as in Jersey, Guernsey, and in other places. It was first brought into Ayrshire, in Scotland, from the island of Jersey, by John, earl of Loudoun, during spring, in the year 1766. And that, on being sown in a heavy clayey soil, and upon one of a more early kind, in the former on the 7th of April, and in the latter on the 4th of the same month, it was reaped or cut down on the 26th of September in the first case, and on the 4th of the same month in the last. In both instances, it afforded ten Linlithgow bolls of wheat, which are above forty Winchester bushels, upon the Scotch acre. When the grain was weighed, a boll of it was found to be only two pounds lighter or less than a boll of winter wheat.

Spring wheat of the true kind, though sown so late as near the middle of May, has been found to become ripe at the same time with the autumnal or winter wheat, and that there is no benefit gained by early sowing with it, as that which has been put into the ground in April, has become ripe as early as that sown in the beginning of the preceding month. In its growth, it is said by some that it does not tiller in the manner of common or winter wheat, but shoots up and advances immediately and directly from the moment of its appearance above the surface of the ground. The grains or corns, which are smaller than those of the common winter wheat, become larger and finer by being grown on better and more fertile land. It is supposed to succeed well on low fenny sorts of land, which are apt to be flooded during the winter season: and that it is highly deserving of being tried in the mountainous parts of Derbyshire, Yorkshire, Lancashire, and some other northern districts, where little or no wheat is sown, the situations and exposures being too cold and open for wheat sown in the autumn to stand the severity of the winter frosts, thaws, and rains, without perishing and being destroyed. It has been noticed, that though, under particular circumstances, spring wheat, when lately tried, has not always answered perfectly well, yet that in many cases it has succeeded to a wish, and that it is now the prevailing husbandry in an extensive district in the county of Lincoln: that the growth of wheat has become more important and essential than ever, since it has become so much more generally used as food: and that the price now so much better and more fully rewards the industry of the grower or husbandman. All these circumstances being taken into full consideration, no substantial reason can, it is thought, be assigned, why spring wheat should not be raised in every district of this country which is calculated for the growth and cultivation of so important a national resource in this sort of grain, and without the possession of which, it is indeed thought that this country cannot be permanently independent of foreign supply.

The writer of the above Inquiry states, that there are, it is said, about fifty varieties of spring, or this sort of wheat; but that the kind or variety best known in this country has awns like barley, and hence that it is sometimes known under the name of *rough* or *bearded* wheat. The pickle or grain in it is red; but it has not so bold or full a sample as winter wheat, yet it weighs better; it is consequently preferred by all honest millers, who know its nature and

value, as the persons engaged in this business are now mostly beginning to do. Some farmers mix it with different proportions of winter red wheat, as the red Lammas, which resembles it so much in colour, that they never fail to profit by the practice, as it increases the weight of the mixture more than it diminishes the quality of the sample; and besides renders it more productive at the mill. The proportions employed are usually about one half, or rather less than that quantity, in such mixtures. The average weight of spring wheat is mostly about sixty pounds the bushel. The bread made from the flour of it is, it is said, sweeter than that from winter corn of the wheat kind. And that it is likewise more nutritious, as containing a larger proportion of gluten, or half animalized matter, in its composition. The bread is also allowed to be more palatable, it is said, to those who are in the habit of constantly eating it. In proof of its greater power of nourishment and support, the analysis of sir Humphrey Davy has shewn, that it has more gluten or real nutrient matter in it, when compared with other grains of the same kind, than in good winter wheat, in the proportion of twenty-four to nineteen in the hundred. And that in regard to the insoluble matter or part, or the bran, there is only a difference of two parts more in the hundred, when compared with good winter wheat of this country. Consequently, that the difference in price between it and such wheat, when of equal weight, should only be in that proportion.

The advantages which attend the more general introduction and growth of this sort of grain or wheat, are partly of a private, and partly of a public nature. In the former point of view it is of great importance, it is said by the writer of the above inquiry, to have it in the power of the farmer to raise so valuable an article as wheat, though sown late in the spring, or even in the beginning of summer. It was formerly generally conceived that after turnips, which was considered as the basis of good husbandry on light sorts of land, that barley, including bear or bigg, was almost the only crop that could be raised and grown with advantage, as the sowing of winter wheat in the spring could only be attempted or practised in a partial manner. But it now appears that spring wheat may be raised and grown with as much ease and facility, and with more profit, than the inferior sorts of barley, too great a quantity of which is grown at present, since the exportation of grain has been checked and restricted, and such enormous duties laid on malt. But here is a resource, it is said, which, if aided by a prohibition of foreign wheat from being imported, unless at augmented rates or prices, would always enable the farmer or grower, where his situation and the nature of his land are suited to the cultivation of it, to proceed in his useful and industrious career with proper inducement, energy, and spirit.

A still further most important circumstance in favour of spring wheat is, that, it is said, of its not only being exempt from the blight or mildew, but also of its not being liable to any risk of damage or injury from the grub or wire-worm: and this is a matter which is not to be attributed to the nature of lands or seasons; for the farmers of the extensive tract or district of country known by the name of South Holland, in the county of Lincoln, in which there are various kinds of land, uniformly declare, that they were compelled, many years ago, by the frequent attacks of the blight and mildew, to abandon almost entirely the sowing of winter wheat, and to substitute spring wheat in its place or stead. That spring wheat is not liable to the disease of blight or mildew, has also been lately shewn by a field of twelve acres, which was totally, it is said, exempt from that disease, in a

district where every other field was in a most miserable state or condition with it. In the corrected account of the "Agriculture of the County of Essex," it is stated, however, that there is an instance of spring wheat being mildewed: and that Mr. Bailey, of Chillingham, states, in a letter to the writer of the "Inquiry," that spring wheat, sown in the month of March, was affected with the mildew, while the same sort, sown on the 2d, the 3d, and the 10th of May, escaped; also, that some spring or bearded wheat of the last crop, suffered from that disorder where it was thick on the ground, probably owing to the want of air; for where it was thin, it escaped. The writer of the "Inquiry," however, conceives, that a few exceptions cannot overturn a general rule, which was recognized above a century ago in the "Systema Agriculturæ," printed in the year 1681, and which repeated experience has since sanctioned. They, however, sufficiently prove that it is not wholly incapable of receiving the disease under particular circumstances and modes of growth. The authority of the work quoted is probably of no great consequence, as real spring wheat was at that early period but little if at all known or cultivated in this country. The fact or matter can perhaps only be satisfactorily ascertained and decided by more full and correct experimental trials than any which have hitherto been made. It is a very material point in its favour, however, that it is a vast deal less liable to the disease than autumnal or winter wheat, which is allowed on all hands.

It should, however, be noticed, that it is liable, as in the other kind of wheat, to be affected with the smut, and consequently that it must be carefully washed, brined, or pickled, in order to avoid any risk of the disease, with a very highly saturated solution of common salt, in such a manner as to prevent the danger of this sort of infection being communicated in any way, and then dusted over with quicklime, as has been occasionally practised, and as will be more fully shewn in speaking of steeps and steeping grain. See STEEP, and STEEPING Grain. See also SMUR.

In the latter of the above points of view, the advantages of raising this sort of wheat are not less important. The writer of the "Inquiry" states, that for several years past we have depended on importation for a part of our food. We have sent abroad, it is said, above thirty millions sterling, to enrich and improve foreign countries, the most part of them lately in a state of hostility against us; and that so regular were our demands, that they were led to imagine that we could not exist without their assistance in this way. What, therefore, can, it is asked, be more desirable than to put an end to such a disgraceful dependence upon such nations, which, by the growth and cultivation of spring wheat to a considerable and sufficient extent, may at once be completely and effectually accomplished? It seems to the writer, indeed, of such essential importance, that until the system or practice is thoroughly established, some legislative encouragement, to increase the growth and cultivation of this sort of wheat, would be in the highest degree expedient. How much better, it is said, is it to promote domestic cultivation and improvement, than to bestow bounties on the importation of mere trash, the refuse of foreign granaries, of which such quantities are commonly sent to this country in times of scarcity?

It may consequently be fairly asked, whether the cultivation and growth of spring wheat should not be considered as a national resource of very great magnitude and importance; and as such be strongly inculcated on, and recommended to, the attention of the public? The utility and consequence of it in this way, in times of scarcity, have indeed

indeed been enforced by the first of the above writers and others, by observing that the price of wheat seldom advances much, even in very scarce years, until a considerable portion of the crop has been threshed out, and the yield of it by this means ascertained, but that this does not take place until the seed-time of winter wheat is wholly over and past; no speculation, consequently, of sowing an increased quantity of that grain, can be entered into, during the first year of a scarcity; but before the end of April, the question of the average yield of the preceding crop will be generally known, and when it is much below the usual proportion, there can, it is supposed, be no doubt, that a large quantity of spring wheat will be sown, if the seed can be easily procured. And that when there is, in the early spring months, any general appearance of defect or deficiency in the autumnal sown crops, from whatever cause it may arise, spring wheat ought to be sown, in such proportion as may suffice for yielding a produce equivalent to such probable defect or deficiency: and that if the stock of wheat on hand should prove scanty, or of inferior quality, either from mildew or other causes, there is, on these accounts, a necessity to have recourse to the sowing of spring wheat, in order to augment and increase the stock on hand. It is thought more especially necessary by the writer of the "Inquiry," to promote the cultivation and growth of spring wheat in a more general manner, because, unless it be grown to some extent, no quantity of seed will be capable of being procured, however necessary it may become from the circumstances of the times, as for instance, a complete failure of the winter-sown wheat, at once to increase the quantity that is to be sown. And that though spring wheat may not be so saleable, in favourable seasons, as winter wheat, at least in the metropolis, and its immediate neighbourhood; yet as it can be raised in various parts of the country, where winter wheat will not grow; and as it may be applied to different useful purposes besides the article of bread; there is no reason, it is supposed, why the cultivation of it should not be promoted. It is always a resource which can be resorted to in times of scarcity, with much more advantage to the country than importing foreign grain, to the disgrace, and it might almost be added, it is said, to the destruction of the agriculture of this country. There are some, however, who think foreign wheats more valuable and useful than those of this country, as will be seen in speaking of wheat. See **WHEAT**.

It is said, that it has been objected to the grain of this sort of spring wheat, that it is of a hard and stinty quality; but that our millers find no difficulty in grinding it; and it is well known, that the harder and more stinty the pickle, the better and livelier is the flour. The most stinty wheat, it is remarked, may be ground with facility, when properly damped. And that the French, when in Egypt, were taught by the millers there, to suffer their wheat to steep a few hours in water, and the grain, when afterwards dried in the sun, was ground without difficulty. In this country, it is suggested that it might be kiln dried, or otherwise, perhaps, by fire heat.

The same writer observes, it is also said, that barley is a safer crop, and that oats would be more profitable. In regard to safety, no crop, it is said, can be more certain than spring wheat, when it is sown in a proper season, with good, well washed, or pickled seed, in the manner already stated, and on land properly prepared for its reception; and as to profit, were a crop of oats to be equally, or even more valuable, which is far from being the case, yet such a scourger or exhauster of the ground could not be recom-

mended, in preference to a crop that does not exhaust or deteriorate the land more than barley would; and yet, if other crops of wheat should fail, would be much more valuable and useful.

In the metropolis, however, it is said, where they are accustomed to the finest wheats, and where fashion and habit render it necessary to make the bread as white as possible, this kind of wheat is objected to as coarse, thick-skinned, and as producing clammy flour. It consequently finds no favour with the millers in the neighbourhood of that great city, who, it is said, in times of scarcity, would only buy it in small quantities, at a price two-thirds lower than that of the common sorts; and in years of medium produce, would not purchase it, in quantities, at almost any price. This, however, it is said, is altogether owing to the prejudices and habits of a rich and luxurious capital, and will not probably influence the rest of the kingdom. Besides, if it be thought essential for the public interest always to have a considerable quantity of this species or sort of corn grown in this country as a national resource, the policy of which, it is thought, would seem unquestionable, government might in various ways promote the sale of this spring sort of wheat; as, by permitting the exportation of it, when the price is ten shillings the quarter less than that of other wheat; by restricting the manufacture of starch to the use of it, if it can be employed in that way; by permitting the consumption of this sort of wheat in the distilleries, while a prohibition exists as to other wheats; by making all the biscuits for the navy of it alone, as it seems peculiarly well suited for that use; and probably by different other means.

It is stated, it is said, that these advantages cannot be given to spring wheat, because it is impossible to distinguish it from coarse or partially mildewed winter wheat; but some risk must be run, the writer thinks, to insure so great a public object and advantage as a regular supply of food by domestic industry. And if some low-priced or damaged winter wheats were mixed with spring wheat, and exported, distilled, or made into starch, it is not seen that any injury or inconvenience from such a circumstance would be sustained by the public. It is better, it is supposed, except in instances of dearth and scarcity, to get rid of inferior wheats in any way, than in bread.

In regard to the sorts of land, and the situations in which this sort of wheat can be produced, it has been found, that almost all the kinds, from the clayey marly descriptions, to those of the light sandy sorts, are capable of affording it; but that it is obviously the most suited to such light lands as are remarkable for promoting a quick vegetation and growth in the grain. And it is of great importance to be known, that land of the fenny kind, with a bottom of the turf-earthly sort, is particularly calculated for the growth of this sort of wheat, and that it rises in a more quick and speedy manner on such land than on any other kind. Lands of this quality not being well suited to the growth of winter wheat, which is liable to be thrown out of them by frosty seasons, on account of their lightness; by having all such lands, in the different parts of the united kingdom, sown in suitable courses with spring wheat, a vast scarcely calculable advantage, it is thought, would be produced.

It is also a matter of very great moment, it is said, that spring wheat is capable of being grown in different districts where winter wheat cannot be raised at all, nor any other sort of crop of nearly the same value or importance; as, for instance, in the northern parts or Highlands of Scotland, where they grow an inferior sort of barley, commonly called

bear or bigg, which is now become of little value, in consequence of the pressure of taxation; as, from the quickness of its growth, it would be the most likely to answer and succeed in such situations. Were only one half of the ground now employed in the growth of bear or bigg crops, it is said, appropriated to the raising of spring wheat; it would furnish a quantity of this sort of grain, equal to the usual average of imported wheat, and any foreign supply be unnecessary. The propriety of growing spring wheat in these situations, and the islands connected with them, is still more strongly enforced, it is said, by the high opinion which has been formed of it by the late Dr. John Walker, professor of natural history in the university of Edinburgh, in a work lately published, entitled the "Economic History of the Hebrides and Highlands of Scotland," which is equally deserving the attention of the southern, as well as the northern cultivator, though more particularly calculated for the latter. After noticing the time and manner in which it was brought into that country, as already seen, and the nature of its growth and produce in different sorts of land, it is remarked, that it "will be allowed, that our common winter wheat could not have afforded such a crop, or indeed any crop in the same space of time. It appears, therefore, to be a grain better adapted for a northern than a southern climate; that it might be raised in many parts of the south of Scotland, where winter wheat is not sown; and that of all the different sorts of wheat, it is the most promising to be attempted in the Highlands."

In respect to the means of procuring or providing the seed of this sort of wheat, it has been stated by Sir Joseph Banks, in a paper inserted in the fifth volume of Communications to the Board of Agriculture, that as in the neighbourhood of the towns of Bolton and Spalding in Lincolnshire, the growth and cultivation of it are now fully established, and likely to continue; from either of these places, consequently, the seed may at any time be procured without difficulty, in such quantities as are wanted, even when considerable; and that, as there is a water communication between these two places, and as the former is a sea-port, it may always be brought to the metropolis, or any other maritime part of the country, at a small charge. It may constantly be had at the above sea-port at the same or somewhat less prices than winter wheat. And any of the principal merchants at it may be depended on for a proper supply. In small portions, many of the chief seedsmen in the metropolis or any large towns can mostly supply it.

It would appear on the whole, from the account which has been given of the history, nature, properties, uses, and advantages, as well as other circumstances in respect to spring wheat, that a more full and general introduction of it into the systems and practices of arable farming, especially on light and some other lands, where the regular wheat husbandry cannot be carried on, must be of very considerable importance, not only to the interests of individuals, but to the nation at large, in affording better and more certain profits, and at the same time guarding against the danger of scarcity.

SPRING Bay, in *Geography*, a bay on the N.E. coast of the island of Barbadoes.

SPRING Island, a small island near the coast of South Carolina. N. lat. 32° 22'. W. long. 80° 57'.

SPRING Township, a township of Pennsylvania, in Centre county, containing 1550 inhabitants.

SPRINGE, or *HALLERSPRINGE*, a town of Westphalia, in the principality of Calenberg, the chief trade of which consists in beer; 12 miles E. of Hameln.

SPRINGER, in *Ichthyology*, a name given by authors to the grampus.

SPRINGERS, in *Architecture*, the ribs of a groin, or concentrated arch, which spring from their respective impost, and meet together in an orb or knot in the centre of the whole vault. The ribs of the arches were usually made of hard stone, while light top stone or chalk was preferred for filling up the interstices.

SPRINGES, a sort of horse-hair nooses, made so as to run very easy, and planted in the places where birds run in some particular path, to take them as they pass.

Those birds that frequent the waters, or love to paddle and feed in wet and plashy places, are the most easily taken by snares.

The sportsmen who would use them to advantage, must first carefully search out the haunts and places where the fowls come in flocks, or in couples, and feed in the morning and evening hours. The furrows and water-tracks in these places are principally to be regarded; and wherever the several furrows, or water-courses, meet in one, and afterwards divide into several others, these places are to be remarked above the rest: the places which have most marks of the birds' feet, give also the surest of all proofs, that they are well frequented. When these places are found, there should be placed a number of small and short sticks cross-wise athwart all the other passages, one stick being placed about half an inch from another, and making together a kind of fence, guarding every way, except that one through which it is intended the fowls should pass. This being done, a good stiff stick is to be provided, cut flat on each side; both ends of this stick are to be planted under water, so that the upper part of the flat side may only be upon a level with the surface; then a bow is to be made of hazel, or willow, in the form of a pear, broad and round at one end, and narrow at the other, and at least a foot long, and five or six inches wide: at the narrow end of this there is to be a nick, or dent. Then a stiff young grown plant of hazel, elm, or withy, is to be chosen, being bushy and clear, and without knots, three or four inches about at the bottom, and about an inch at the top. Having made the bottom end of this sharp, at the top of it there must be fastened a very strong loop, made of about a hundred horse-hairs, platted very fast together with strong packthread, and made to slip any way with great ease. This noose or loop should be just of the dimensions of the pear-fashioned hoop before-mentioned. Then hard by this loop, and within an inch of the end of the plant, there is to be fastened, with strong horse-hair, a broad and thin trigger, made sharp at both ends. Then the bigger sharp end of the plant being made fast in the ground, just by the edge of the water, the smaller end, with the loop and the trigger, must be brought down just to the first bridge; and the pear-fashioned hoop being set upon the bridge, one end of the trigger must be set upon the nick in the hoop, and the other end on the nick made on the small end of the plate, which by the violence and bend of the plant will make them all stick together till the hoop be removed. This done, the loop is to be laid upon the hoop in such fashion as the hoop is proportioned; then from each side of the hoop little sticks are to be pricked, as before directed, making as it were a kind of impaled path-way, widening it all the way as it goes farther from the hoop, and making it so considerably wide at the end, that any fowl that chances to come that way may be entered a considerable way in before she perceives the fence; by this means the bird will be enticed to go straight on to the springe, and as soon as she touches it, either with head or feet, she will be certainly caught; and thus, if the plant

be strong enough, the largest bird may be caught as easily as the least.

When the smaller fowls, that frequent watery places, are to be taken by this engine, it is to be made only a great deal lighter. When it is intended for snipes, woodcocks, or the like, the main plant may be of willow, hazel, or grown osier, or any other pliant wood that will easily bend, and will recover its straightness again. The use of this engine is limited to the winter season, and to times when there is much wet upon the ground. If there happen any great frosts, so that there is no advantage to be made of the wet places first described, then the sportsman is to look for some place where there is a considerable fall, and where the current is not frozen, and in this place the springes are to be set; and the greater the frosts are in this case, the more birds will be taken.

There is another use of springes for birds, which is the taking, by means of them, certain birds on the boughs of trees and in hedges, which is often attended with very great success. The sportsman, for this purpose, must first mark some tree where the birds very much resort; then fix on some particular branch that is tolerably straight, and cutting off all the twigs to within a foot or two of the top, he is there to bore a hole through the branch with a piercer or wimble, large enough to admit a goose-quill. Then another branch is to be pitched upon, at about a foot distance from the first, and all its boughs are to be pared away up to a certain height. There is to be fixed to this branch a packthread of half a foot long, and at the end of this is to be tied a noose of plaited horse-hair. The branch to which the packthread is fastened is then to be stooped so far, that the noose may be brought through the hole in the other branch, and fastened there by means of a little stick four fingers long, and hooked at the end just fitting the hole, and so brought into it, as just to stop the flying back of the other branch. Then there is to be placed beyond the noose some bait of a fruit, or insect, as a cherry, a pear, or a worm, or any other thing of which the bird, intended to be taken, is known to be fond; this is to be set in such a manner, that the bird can no way get at it but by setting its feet on the small stick which supports the noose and stops the hole. The weight of the bird will throw down the stick, and the bird will then be caught by the legs, and tied fast to the branch where the hole is, by the flying back of the other branch where the packthread is fastened.

There is yet another method in use for the taking many kinds of birds, from the partridge or pheasant to the black-bird. This is made in the following manner, and is to be placed either on the ground, or on a tree, bush, or hedge, according to the nature of the bird intended to be taken by it. A straight and even piece of willow, or fallow, is to be chosen, of about six feet long, and of the thickness of a walking cane; this is to be sharpened at one end, and stuck down into the ground, and at the other end there is to be fastened a small crook; then two holes are to be made in the stick, the one big enough to admit a goose-quill, the other smaller: and a piece of stick is to be chosen, which being bent, will spring back to its straightness again, such as holly, or the like: this should be about three feet long, and the larger end of it is to be fixed in the larger hole of the first stick; the smaller end must have fastened to it a packthread, at the end of which there is a noose of horse-hair: this is to be brought through the smaller hole, and be pegged in so slightly, as just to prevent its flying back of itself. Then the springe or noose is to be spread on the peg, and a bait, proper for the bird to be taken, is to be

placed at a proper distance; so that the bird cannot come at it but by treading on the peg, which will give way under its weight, and the stick, to which the packthread is fastened, will fly back, and the bird will be consequently caught in the noose, and have its legs drawn close to the other stick.

SPRINGFIELD, the *Aaggavan* of the Indians, in *Geography*, a post-town of America, in the state of Massachusetts, and county of Hampshire, on the E. side of Connecticut river; 97 miles W.S.W. of Boston. This township was incorporated in 1645, and contains 2767 inhabitants, a congregational church, a court-house, and a number of dwelling-houses, many of which are spacious and elegant. The town lies chiefly on one spacious street, running parallel with the river. A stream from the hills, at the eastward of this town, falls into this street and forms two branches, which run in opposite directions, one northerly and the other southerly, along the eastern side of the street, supplying the inhabitants with a supply of water for domestic uses. This place has a considerable inland trade, with a paper-mill, arsenal and armoury.—Also, a town of New Hampshire, in the county of Cheshire, containing 814 inhabitants.—Also, a town of Vermont, in the county of Windsor, on the W. side of Connecticut river, opposite to Charlestown in New Hampshire, containing 2556 inhabitants.—Also, a post-township of New York, at the northern extremity of Otsego county; 58 miles W. of Albany; its area being equal to about six miles square. Its surface is undulated with hills and vallies, and well divided into arable, meadow, and grazing lands. The soil in the vallies is principally a deep rich mould. It has several mill-streams; three houses for worship, one for Presbyterians, one for Congregationalists, and one for Baptists; and twelve or thirteen school-houses. In 1810 it contained 1346 inhabitants, principally composed of English, Irish, Dutch, and Scots emigrants. It derives its name from a large, deep spring.—Also, a town of New Jersey, in the county of Essex, on Rahway river, which furnishes fine mill-seats; 8 or 10 miles N.W. of Elizabeth town; containing 2360 inhabitants, of whom 45 are slaves.—Also, a post-town of New Jersey, in Burlington county, having good soil, and famous for its cheese. The inhabitants, who are principally Quakers, having three meeting-houses, amount to 1500. The business is chiefly transacted at a village called Job's Town, 10 miles from Burlington. In this township is a hill, called mount Pisgah, which furnishes stone for building. This township has a grammar-school.—Also, a township of Pennsylvania, in Montgomery county, containing 550 inhabitants.—Also, a township of Pennsylvania, in Bucks county, containing 1287 inhabitants.—Also, a township of Pennsylvania, in Delaware county, containing 541 inhabitants.—Also, a township of Pennsylvania, in Huntingdon county, containing 751 inhabitants.—Also, a township of Pennsylvania, in Mercer county, containing 330 inhabitants.—Also, a township of Ohio, in the county of Champaign, containing 598 inhabitants.—Also, a post-town in Hampshire county, Virginia, 140 miles from Washington.—Also, a post-town in Washington county, Kentucky, 629 miles from Washington.—Also, a township of Ohio, in the county of Columbiana, containing 601 inhabitants.—Also, a township of Ohio, in the county of Hamilton, containing 2063 inhabitants.—Also, a township of Ohio, in Jefferson county, containing 746 inhabitants.—Also, a township of Ohio, in the county of Muskingum, containing 919 inhabitants.—Also, a township of Ohio, in Portage county, containing 510 inhabitants.—Also, a township of Ohio, in Ross county, containing 972 inhabitants.—Also, a town

town of Kentucky, in Washington county, containing 249 inhabitants.—Also, a poll-town in Robertson county, Tennessee, 763 miles from Washington.

SPRINGHILL, a township of Pennsylvania, in Fayette county, containing 1837 inhabitants, of whom nine are slaves.—Also, a township of the Indiana territory, in the county of Clark, containing 1107 free inhabitants and seven slaves.

SPRINGVILLE, a township of the Indiana territory, in the county of Clark, containing 1380 free inhabitants and 13 slaves.

SPRINGY or **ELASTIC Body**. See **ELASTIC Body**.

SPRINGY Land, in *Agriculture*, such as is subject to the breaking forth of small oozing springs. It is a sort of ground very troublesome to the farmer in the cultivation, as requiring much draining, and other management, to render it proper for cropping. See **DRAINING of Land**, and **SOIL**. See also **SPRING-Draining**.

SPRINTZNSTAIN, in *Geography*, a town of Austria; 7 miles S. of Aigen.

SPRIT, in *Agriculture*, a term sometimes made use of to signify a young sprout or shoot, as in the case of new-sown grain of any kind. Thus, new-sown corn is often said to be just sprit, by the farmer. It also denotes, in some cases, sprouted corn; as that which is grown or sprit in the sheaf or straw, in the field, from moist weather.

SPRIT, in *Sea Language*, is a small boom, or pole, which crosses the sail of a boat diagonally, from the mast to the upper hindmost corner of the sail, which it is used to extend and elevate: the lower end of the sprit rests in a sort of wreath or collar, called the *snolter*, which encircles the mast in that place: sails of this kind are accordingly called spritsails. See **SAIL**.

SPRITSAIL, a square sail used under the bowsprit.

SPRITSAIL-Top-sail, a square sail used under the jib-boom, but is no longer to be supplied in the navy.

SPRITTING, in *Agriculture*, a term applied to the act or process of germinating, sprouting, or shooting forth, either in the work of vegetation, or the operation of malting barley, or other kinds of grain. It is of much consequence, in both these cases, that the process takes place in a proper manner; as, without it, neither good and perfect field seed-crops nor malt can be produced. In moist or wet harvest seasons, the spritting of the grain, or other matters, in the sheaf or stouk, in the field, is often of much injury, inconvenience, and loss to the farmer, and should always be guarded against as much as possible, by proper stouking, hutting, mowing, or some other means in such a situation. See **HARVESTING Grain**.

SPROD, among the fishermen of many parts of England, a name given to the salmon while in his second year's growth.

SPROE, in *Geography*, a small island of Denmark, situated in the Great Belt. Vessels which pass the Great Belt in winter are often obliged to shelter here, though there is only one farm on the island. During winter the post regularly stops here; and an ice-boat, conducted by five men, is provided for the convenience of passengers, letters, &c.; 8 miles N.W. of Corfoer. N. lat. 55° 22'. E. long. 10° 50'.

SPROTTAU, a town of Silesia, in the principality of Glogau, on a river of the same name, at its conflux with the Bober; 21 miles W.S.W. of Glogau. N. lat. 51° 32'. E. long. 15° 32'.—Also, a river of Silesia, which runs into the Bober, at the town of Sprottau.

SPROUT, in *Agriculture* and *Gardening*, the common

name of the young shoot, offset, or sucker, which is thrown or sent off from any part of a vegetable of the plant, tree, or shrub kind.

Fruit-trees and shrubs, which are designed for production, must constantly be kept pretty free from these sorts of sprouts, shoots, and suckers, or their capability of affording good fruit will be much lessened and restricted. This is particularly the case in the gooseberry and currant shrubs, which scarcely produce any at all, where they are let remain. See **OFFSET** and **SUCKER**.

In hedge plants, however, the sending off numerous sprouts or shoots from the inferior and bottom parts of their roots and stems, is often of very considerable utility, in rendering the lower portions of the fences more thick and close, where it does not too much injure the growth and strength of the plants which are made use of for the purpose, as is sometimes the case. See **HEDGE** and **QUICKSET Hedge**.

In the practice of gardening, sprouts or shoots are occasionally, though not frequently, employed for raising new crops of vegetables of the same kind as the original plants. This is sometimes the case in the cabbage, and a few other similar kinds, as well as in some sorts of tree and shrubby plants.

But though the slips of the sprouts or shoots, in the cabbage tribe of plants, will readily take root and grow, when planted out while they are in a young state, they are only proper to be made use of in this way in an occasional manner, in particular cases and circumstances; as, for instance, in planting them for seed in any particularly good and valuable sort. In which case, some of the best slips of the sprouts, in the more early crops, may be taken off, on the approach of the autumnal season, and be planted out in rows, at the distance of about two feet from each other, giving them frequent waterings at first, when they will take root and grow so as to establish themselves in a ready manner, shooting up to form seed-stems in the ensuing spring, from which seed of the most perfect kind may be collected and secured.

The sprouts, suckers, and shoots, of plants of the tree or shrub kinds are, in some cases, slipped off and used in raising young trees and shrubs of the same sorts as the originals, with the greatest certainty, and in the most easy and expeditious manner. In such intentions, the slips or shoots are, for the most part, taken off in the early spring, or towards the autumn, and planted out in rows in the nursery grounds, at suitable distances, according to their nature and habits of growth; or placed in pots, to be set out in the open ground, or to be forced forward by the heat of the hot-beds, in the stoves, hot-houses, frames, and other similar compartments of the garden. They are afterwards, as soon as they have stricken or taken full root, in many cases, removed and put out in different ways, according to circumstances, and their particular nature and habits, as is shewn in speaking of the culture of the different sorts, under their proper heads.

SPROUTS, Esculent, the fine, small, young, tender, green shoots, which are sent off and produced from the sides or other parts of different kinds of culinary vegetables or plants, and made use of as human food at different periods and seasons of the year. There is a great number of garden vegetables which afford sprouts of this nature, and some in considerable abundance as crops for this purpose; as those of the *brassica* tribe in particular, as seen below.

In some herbaceous esculent plants the young sprouts are excellent eating, as in the cabbage kinds, and some others, affording

affording a very profitable after-crop. The sprouts produced on the stalks of the early-cut cabbages often also cabbage into tolerable little firm heads towards autumn, in the sugar-loaf cabbage particularly, and other forward kinds; producing abundance of fine sprouts in summer, which, being gathered while young and green, constitute some of the most excellent culinary greens of the season. Likewise forward favoys, being cut early in autumn, the remaining stalks produce fine large sprouts the same year, fit for use in the early part of winter: later crops of the same plants produce also abundance of small sprouts in the spring; and the borecole is remarkable for its great production of sprouts towards spring, emitted all along the small stems from the very bottom to the top: also, purple broccoli never fails to produce a secondary crop of excellent sprouts, furnished with little tender heads.

In the culture of all the varieties of the cabbage kind, it is proper, therefore, after gathering the main heads, to leave a quantity of the stalks of the best and more forward crops, of the respective sorts, to produce sprouts; and if, towards autumn or winter, and other seasons, the ground should be wanted for other crops, the stalks may be removed, and trenched in by the roots in another place, not in a shady bye corner, as often practised, nor placed too close, as the sprouts would, in such cases, prove small and trifling, and be liable to be eaten up by slugs; but in an open situation, in rows a foot asunder: in which method the sprouts will continue their growth in much greater perfection, though probably not in so good condition as if the stalks had remained undisturbed.

As the stalks of cauliflowers and cauliflower-broccoli rarely produce any sprouts, it is needless to leave them standing on the ground, after their heads have been cut from them.

The sprouts of this kind which are produced in the summer and autumnal seasons are by much the finest, and continue the longest in perfection; yet, though the spring sprouts may be of a smaller size, and continue a much shorter time before they run up for producing seed, they are, notwithstanding, often found highly advantageous, useful, and acceptable at such a season, on account of the great deficiency of other sorts of green vegetable products, and for the variety which they afford at the table.

All sprouts of this nature, and for this use, should constantly be plucked or taken off from the stems of the old plants while they are in their young, full, and early growth, in order that they may boil in a green and tender manner; as they are liable to become hard and sticky, when left to an old state of growth, and are not by any means so saleable in the market.

SPROUTS or Shoots of Potatoes, Planting of. These are the sprouts, shoots, or running branches, which are sent off from them in their early growth. Such young sprouts or shoots have lately had different experiments made with them, by which it has been shewn, that they are capable of being used with advantage in raising crops of this very necessary root, in some cases. In Sussex, the earl of Egremont, according to the writer of the corrected account of the agriculture of that district, has taken much interest in trials for raising them in this way.

In regard to the method of breaking off the sprouts or shoots from the potatoes, there is no reason, it is said, to be apprehensive how or in what manner they are taken off; and if the sprouts or shoots, after they have been separated from the potatoe, be put into a basket, and have a little earth thrown over them, they will keep in this state, it is asserted, if not immediately wanted, for months. The

kidney potatoe, after its second cropping, is noticed to decrease in the number of its sprouts or shoots. No sort is supposed to equal the red cluster kind. The early kidney comes up before any other sort; the cluster is the next; and the ox-noble the last. The cluster throws out more sprouts or shoots than any other kind, even so far as up to thirty at a time.

The sprouts or shoots are planted promiscuously from one to six or seven inches in length. Until the third or fourth month after planting, the sprouts or shoots have, it is said, but a small apple, not above the size of the end of a person's finger; but afterwards they wonderfully increase their size. Hence it follows, it is supposed, that the eye, having a greater and more substantial root to support the vegetative power of the plant, comes easier to perfection; but that the sprout or shoot, though stationary at first, will in the end more than equal the other in produce; and if to this be added the saving of seed, the advantage will be still more considerable.

Hence it is said, that it may be inferred, that this method of cultivating the potatoe, which is practised at Petworth, in the above county, with success, merits the attention of farmers, and probably of garden cultivators also. For an early market it is the only method, it is thought, of raising them; and besides, the seed and expences of cutting are saved.

It has been long known that the potatoe is capable of being readily raised by planting the sprouts or shoots, and recourse has, for a considerable length of time, been had to it, in some measure, for the production of early crops, in the county of Lancaster.

The want of substance in the sprouts or shoots would seem to be a great objection to the sprout manner of raising potatoe crops, as there must be a deficiency of support in the early growth of the plants which constitute such crops; as it has been found that even small cuttings, where the eyes are preserved, are not so good for raising full crops, on account of their want of substance, as those of large ones; and scooped eyes, as sets, have now almost been wholly rejected by cultivators, in consequence of their defect of substantial nutrient matter for the support of the young plant in its first or very infant growth. The matter remains, however, to be fully cleared up, and placed in a decided point of view, by more full and more correct trials made directly in this intention, as the sprouts or shoots are unquestionably the natural modes in which the plants are raised. See POTATOE and SOLANUM.

SPROUT-Hill, a name sometimes given to the ant-hill. See *ANT-Hill*.

The most ready way of removing sprout-hills is probably by frequent heavy rolling of the land, immediately on their first appearance. The turning of a stream of water over the ground, where it can be conveniently done, may also sometimes perhaps be effectual in the same intention. There are different implements and machines which perform this sort of work in a very complete, expeditious, and effectual manner, that may be had recourse to for the purpose. See *SWARD-Cutter*, and *STRIKING Ant-bill Machine*.

SPROUTING, the germination or first sending forth of young sprouts from seeds, cuttings, or plants.

The sprouting and early growth of almost all sorts of field and garden seeds and plants are greatly promoted by placing them to proper depths, in properly dry and suitably rich soils and situations, as well as by a nice attention to their culture, while they are in their young rising state or condition. This is particularly the case in the latter sorts of seeds and plants.

SPRUCE, *Essence of*, a fluid extract, prepared by coc-tion of the twigs of the wild pine or Scotch fir. See **PINUS Sylvestris**.

SPRUCE-Beer, a beverage made of the essence of spruce, fermented with sugar or molasses and water.

SPRUCE, in *Geography*, a small American lake of New Hampshire, near Chesterfield.

SPRUCE Creek, an American creek, which winds its course through the marshes from the mouth of Piscataqua river five or six miles to Kittery, in York county, Maine.

SPRUNT, in *Rural Economy*, a term signifying a steep road, or one on which there is much difficulty in passing with teams, and which requires great exertion in them.

SPRY, in *Agriculture*, a name sometimes applied to the flat broom which is used with the casting shovel, in the operation of cleaning grain, for sweeping off the chaffy materials that collect in the work.

SPRY Harbour, in *Geography*, a bay on the south-east coast of Nova Scotia. N. lat. 44° 42'. W. long. 62° 40'.

SPUD, in *Agriculture*, a tool or implement of the fork sort, with three broad prongs of considerable strength, which is useful for several different purposes. See **HOP**.

SPUDING, the practice or operation of digging over the hop-grounds, by means of the spud, in different districts. This sort of work should always be fully, carefully, and expeditiously performed, as a great deal of the success of the crops depends upon these circumstances. See **HOP**.

SPULLERS of Yarn, in our *Old Writers*, persons that work at the *spole*, or *wheel*. It also denotes triers of yarn, to see if it be well spun, and fit for the loom.

SPUN-HAY, in the *Military Art*, hay twisted in ropes, very hard, for an expedition in the winter time; each trooper carrying as much as he can behind him.

SPUNGE, or **SPONGE**, *Spongia*, in *Natural History*, a kind of marine substance, found adhering to rocks, shells, &c. under cover of the sea-water, or on the sides of the rocks about the shore. See **SPONGIA**.

The ancients distinguished two kinds, *male* and *female*: but the moderns make only one kind; which, however, they distinguish, with regard to its texture, into *coarse* and *fine*.

Naturalists have been embarrassed in all ages, whether to range sponge in the animal, mineral, or vegetable family. Some would have it a concretion formed of the sea-mud; others have commonly supposed it to be a vegetable production: but it is now allowed to be, like the corallines, of animal origin; being the fabric and habitation of some species of worm or polype.

Dr. Peyssonel has actually discovered and described the worms that form four different species of sponges, without having it in their power to dilate and contract them, as some naturalists have supposed; the sponges being altogether inanimate bodies, and insensible to the touch, or to any motion of the sea, or any other accident, and formed by the juice or slaver which is deposited by the worms that inhabit them. *Phil. Transf. vol. l. art. 78. p. 590, &c.*

Mr. Ellis, to whose observations on productions of this kind the public are much indebted, informs us, that if we carefully examine a small part of one of those sponges, whose ramifications are large and distinct, in the microscope, we shall find that they rise from many small tubes: these, as they extend themselves upwards, send outside branches in various directions, which inosculate, and, uniting thus with each other, form a compound reticulation quite through the inside of the whole mass. In viewing the extremities of the upper or ast shoots, we may perceive small openings at the

end of their fibres; and as we trace these fibres back from the opening downwards, we see a soft whitish substance, which fills the internal hollow part of all the ramifications through the whole sponge; which ramifications have much the appearance of transparent catgut of an amber colour, and are, without doubt, the lodgments of animals of a particular class. For though we cannot distinguish either vesicles, or cells, or discover any other kind of organization, than that of a hollow tube variously inflected, and wrought together into a multitude of agreeable forms, some branched like corals, some expanded like a fungus, some rising up straight like a column; others broad at top, with a narrow base, and hollow like a funnel, with regular cavities, entrances, or apertures, which are nearly alike in all sponges of the same species; yet, from many obvious resemblances to divers other classes of sea productions, which are found to be of animal construction, and from the chemical analyses of sponges in general, there seems sufficient reason for referring them to the class of animal productions. *Ellis's Nat. Hist. of Corallines, &c. p. 78.*

SPUNGE, or *Sponge*, in *Chemistry* and the *Materia Medica*, is the *spongia officinalis*, for an account of which, see **SPONGIA**. This species of sponge is found chiefly in the Mediterranean and Red seas.

On some of the islands of the Archipelago, the inhabitants are trained from their infancy to dive for sponges, which are generally found attached to the bottom of the rocks. This substance, formerly supposed to be of a vegetable nature, but determined by the observations of Mr. Ellis (see *Phil. Transf. vol. lv.*) to be of animal origin, has been, not long ago, examined by Mr. Hatchett, in the course of his valuable experiments on the component parts of animal membrane. (See *Phil. Transf. vol. xc. p. 352, &c.*) The sponges particularly examined by this ingenious chemist, are the *S. cancellata*, *S. oculata*, *S. infundibuliformis*, *S. palmata*, and *S. officinalis*. When the sponges had been immersed in nitric acid (diluted with three measures of distilled water) during fourteen or sixteen days, the acid became pale yellow, and was changed to an orange colour, by the addition of pure ammonia. After this process the sponges became more or less transparent, and were considerably softened. In this state, if they were touched with ammonia, the part thus touched assumed a deep orange colour, inclining to a brownish-red; and when much softened by the acid, (if afterwards immersed in ammonia,) they were completely dissolved, and formed a deep orange-coloured solution. When digested with boiling distilled water, the sponges afforded a portion of animal jelly or gelatin (see **GELATIN**), which was precipitated by infusion of oak-bark. In consequence of their loss of gelatin, which was imparted to the water, the sponges became less flexible, and more rigid; and the remaining part, when dry, crumbled between the fingers; or, when moist, was torn easily, like wetted paper. From these properties it appears, that sponges only differ from the horny stems of the gorgoniae, and from the antipathes, by being of a finer and more closely woven texture; and this is particularly observable by comparing the coarse sponges (such as *S. cancellata*) with the finely reticulated parts of certain gorgoniae, especially the gorgonia flabellum, when divested of the external membrane. When the sponge, either in its natural state, or especially when its gelatin has been extracted by long boiling with water, is boiled with lixivium of caustic potash, it is completely dissolved in it, and forms an animal soap. Sponge, when heated in a close vessel, gives out an ammoniacal fetid smoke, and is reduced to a black charcoal, which, after incineration, leaves a small quantity of com-

mon salt and some carbonate of lime. The principal constituents of sponge, according to Mr. Hatchett's experiments, are animal gelatin, albumen (which see), a small portion of common salt, and carbonate of lime. Sponge, when cleaned and fit for use, is of a brownish-yellow colour, soft, light, and very porous; absorbing rapidly by capillary attraction as much as it can contain of any fluid in which it is immersed, and again yielding it when compressed.

Sponge is a very useful substance in the arts. In its usual form it is never employed as a remedy; but in surgery, it is a very useful instrument on various occasions.

A sponge applied to bleeding vessels has been found a very successful method of stopping the effusion of blood. *Phil. Transf. N° 478. p. 33.*

For this purpose, a very dry and solid piece, of a cubical or conical form, should be applied in close contact with the vessel, and retained by proper compression; and it will soon adhere with great force. Very large arteries have been prevented from bleeding by this application.

Dry sponge, from its property of imbibing and swelling by moisture, is sometimes used as a tent for dilating wounds and ulcers: for this purpose, after being carefully freed from the small stones generally lodged in it, it is dipt in melted wax, and the wax squeezed out from it in a press. *Lewis.*

Taken inwardly, it chokes; and is, for that reason, cut small, and fried or dipped in honey, and given to quadrupeds to kill them, which it seldom fails to do, by swelling and preventing the passage of the food into the intestines.

The official preparation of sponge for medical purposes is the "spongia usta," or burnt sponge. The London Pharmacopeia directs to cut sponge into small pieces, and to bruise it, that it may be thus freed from any adhering extraneous substance; then to burn it in a covered iron vessel, until it become black and friable; and, lastly, to reduce it to a very fine powder. Burnt sponge consists of carbonate and phosphate of lime, subcarbonate of soda, and charcoal. The principal active ingredient is the subcarbonate of soda; but it is asserted, that a mixture of this principle and charcoal does not produce the effects of burnt sponge. This substance is tonic, deobstruent, and antacid. It has been much recommended in bronchocele, scrophulous affections, and hepatic eruptions. The dose is from ʒj to ʒiij, mixed into the form of an electuary, with powdered cinnamon and honey. In bronchocele the patient is directed to swallow the portion of electuary very slowly, from a supposition that some local effect is produced. See BRONCHOCELE.

Some have pretended to cure the leprosy with it, and others extol it against the bite of a mad dog; but these last are virtues not universally received.

In sponges are found a kind of stones called *cyssolithi*, held good for the worms in young children, and to this purpose given in powder.

SPUNGE, in the *Manege*, is the extremity, or point of a horse's shoe, that answers to the heel of his foot; upon it the calkins are to be made. Thick sponge ruins the horse's heels, and therefore ought never to be used. See SHOENING of Horses.

SPUNGES, *Pyrotechnical*, are made of the large mushrooms or fungous excrescences growing on old oaks, ashes, firs, &c. which, being boiled in common water, then dried and well beaten, are put into a strong ley, prepared with salt-petre, and again dried in an oven.

These make the black match or tinder brought from Germany, used to receive and sustain the fire struck from a flint and steel, &c.

SPUNGE is used, in *Gunnery*, for a cylinder of wood, from ten to twelve inches long, of the same diameter with the rammer, with a piece of sheep or lamb-skin wound about its end, to serve for scouring great guns when discharged, before they be charged with fresh powder; hence called *spunging*. In small guns it is commonly fixed to the other end of the handle of the rammer; but has a separate one in those of a larger calibre.

SPUNGING. See SPUNGE.

SPUNK, a term used indifferently for half-rotten wood, match for guns, and a substance growing on the sides of trees. See AGARIC.

SPUN-YARN, among *Sailors*, a small line or cord, formed of two or three rope-yarns twisted together by a winch; the yarns, of which it is usually made at sea, are drawn out of the strands of old cables, or other ropes, and are knotted together, and tarred. It is employed for several purposes, particularly to fasten one rope to another, to seize block-strops to the shrouds, and to serve ropes which are liable to be chafed, &c.

SPUR was anciently a piece of the armour of a cavalier, fastened to the talar, that is, the hind part of that piece of a complete armour which covers the legs and feet.

The word is derived from the German, *spohr*; or rather the Saxon, *spora*; or Danish, *spor*; which all signify the same.

At present, the spur is a piece of iron, or other metal, consisting of two branches encompassing the horse's heel, and a rouelle or rowel in form of a star, advancing out behind, to prick the horse.

Louis le Debonnair forbade ecclesiastics the profane fashion of wearing spurs. Anciently the difference between the knight and esquire was, that the knight wore gilt spurs, whence the appellation of *equus auratus*; and the squire, silvered ones.

Two sorts of spurs seem to have been in use about the time of the Conquest, one called a pryck, having only a single point, like the gaffe of a fighting-cock; the other consisting of a number of points of considerable length, radiating from and revolving upon a centre, thence named the rouelle, or wheel-spur. Delineations of the first occur in the seals of most of our kings and great barons, prior to the reign of Edward III., and also on the engraved and sculptured figures of cross-legged knights. The rouelle is sometimes found on figures of equal antiquity; instances occurring of the same person being delineated with the pryck-spur on one seal, and the rouelle on another. Some specimens of the pryck-spur are still to be found in the cabinets of the curious.

SPUN, *Order of the Golden*, in Rome, is supposed by several writers to have been instituted by pope Pius IV., in 1559. The badge is a star of eight points argent, and between the two bottom points a spur or.

SPUR, in *Agriculture*, the name of a vegetable disease, which frequently attacks rye, and which sometimes likewise damages wheat. It is found that the grains which have the spur are thicker and longer than the sound ones, and generally project beyond their hulks, appearing sometimes straight, and sometimes more or less crooked; and that their outsides are brown or black; their surface is rough, and three furrows may frequently be perceived in them, which run from end to end. Their outward end is always thicker than that which sticks to the chaff, and the mottled end is sometimes split into two or three parts. It is not unusual to find on their surfaces cavities which seem to have been made by insects. Further, that when a spired grain is

broken, in the middle or centre of it is seen a pretty white flower, covered with another flower, which is reddish or brown. Though this vitiated flower has some consistency, it may nevertheless be crumbled between the fingers. M. Aimen has sometimes found this powder almost as black as that of smutty wheat. These grains, when put into water, swim at first, and afterwards sink to the bottom. If chewed, they leave a bitter taste on the tongue. The chaff appears sound, though what is outmost is somewhat browner than when the ears are found. But all the grains of the same ear are not ever attacked with the spur. The grains which have this distemper stick less to the stalks than sound grains do. And the above writer imputes the distemper to the grains not being impregnated; and asserts, that he has not ever found a germ in grains which had the spur.

It may be noticed, that it has been supposed by some that fogs, dews, rain, and the moisture of the earth, may give the distemper to rye, but without any sufficient reason. M. Tillet is however strongly inclined to think that it is occasioned by an insect, which turns the rye into a kind of gall; and he suspects a small caterpillar as being the cause of this mischief, but cannot speak affirmatively on this point. It has been absurdly supposed to affect those who consume the bread made from grain thus diseased with a sort of dry gangrene in the extreme parts of the body. The nature of this disease in grain, like those of many others, is still far from being fully investigated, so as to form any correct notion of the means of removing or preventing it.

SPURS, in *Old Fortifications*, denote walls that cross a part of the rampart, and join to the town-wall.

SPURS, in *Ship-Building*, large pieces of timber, the lower ends of which are fixed against the side of the bilge-ways, and the upper ends fayed and bolted to the ship's side, to support the ship in launching. They have been much discontinued of late years.

SPUR-Shell, a species of the cochlea.

SPURGE, in *Botany*. See **EUPHORBIA**.

SPURGE-Laurel, or *Mezerion*, *Laureola*, or *Daphne*. See **DAPHNE**, and **DAPHNE Mezerium**.

SPURGE, Olive, the English name of a genus of plants, called by some botanists *chamelæa*; which see.

Others have made the olive spurge a species of euphorbia, or spurge. See **EUPHORBIA**.

SPURGE, Sun, a name by which some call several species of *tithymalus*; which see.

SPURGE-Root, in the *Materia Medica*. See **ESULÆ Radix**.

SPURGEN, in *Geography*, a town of America, in North Carolina; 22 miles N.N.E. of Salisbury.

SPURIOUS DISEASES, in *Medicine*, are such as, in some symptoms, cannot be brought under any distinct head, and, therefore, are called by the name of others with which they most agree. Whence, also, they are often denominated *bastards*, *nothi*.

Such are a spurious or bastard pleurisy, a spurious peripneumony, a bastard quinsy, and the like. See **PLEURISY**, **PERIPNEUMONY**, &c.

SPURIOUS Flesh, is an appellation given by some to the flesh of the lips, gums, and that of the glands, &c.

SPURIOUS Medals. See **MEDALS**.

SPURIOUS Ribs. See **RIBS**.

SPURIOUS Suture. See **SUTURE**.

SPURKETS, in a *Ship*. See **SPURKETING**.

SPURN HEAD, in *Geography*, a cape of England, at the S.E. extremity of the county of York, at the mouth of the Humber, on which is a light-house. N. lat. 53° 38'. E. long. 0° 18'.

SPURNESS, the south cape of Sunda, one of the Orkney islands. N. lat. 59° 7'. W. long. 2° 35'.

SPURNWATER, in *Ship-Building*, a channel left above the ends of a deck, to prevent the water from coming any further.

SPURRE, in *Ornithology*, a name given by many to the bird more commonly called the sea-swallow.

SPURREY, in *Botany*. See **SPERGULA**.

SPURREY, Corn, in *Agriculture*, the common name of a plant of the weed kind, which is common in many parts and situations. It seldom rises above six inches in height, flowers in the beginning of July, ripens its seed in August, and is an annual plant. When it is troublesome as a weed, the best method of exterminating it is by summer fallows, and cutting it down before it can scatter its seeds, which are very small.

Two species of this plant, however, are said to be cultivated in Holland and Flanders, for the winter food for cattle, when there is a scarcity of grass. It is said to enrich the milk of cows, so as to make it afford excellent butter; and the mutton fed on it is preferable to that fed on turnips. Hens eat this plant and its seeds greedily, and they are supposed to make them lay a great number of eggs.

It is a plant which is sown twice a year; the first time in April and May, to be ready in June or July; and the second time after the rye-harvest, to serve the cattle in November and December. The usual allowance of seed is about twelve pounds to the acre.

It is said, that though not cultivated in the county of Berks, it grows there in an abundant manner, and that the seeds of it might be easily collected in any quantity. The cultivation of it has been recommended, by way of trial, on the poor soils about Frilsham and Yattendon, in the above district, by the writer of the account of the agriculture of the county, on the suggestion of an intelligent person. It is stated also, that Roucel, in his "Flora du Nord de la France," has considered it as an excellent late fodder for cows; and that it is made use of in the above countries, as well as in Germany, both in its green state, and when made into hay.

It is likewise suggested, that as the knotted sort of spurrey, though perhaps not equally grateful to animals, naturally over-runs the peat-pits in the Kennets, in the above county, it might therefore be sown with certain effect in such situations.

SPURREY, Purple, an annual weed in dry sandy meadows, and corn-fields of the same dry quality. There are other sorts which are troublesome in wet hedges and woodlands.

SPUR-WAY, in *Rural Economy*, a term applied to a bridle, or horse-way, or road through inclosed lands or fields, and free to any one to ride in by right of custom or usage.

SPUR-WING, in *Geography*, a river of America, in the state of Maine, which runs through Scarborough, W. of Cape Elizabeth, and is navigable a few miles for vessels of 100 tons.

SPUTT, a river of England, in the county of Westmoreland, which runs into the Ken.

SPUTUM, in *Medicine, &c. the spittle or excrement voided at the mouth. See **SALIVA**.*

An examen of the sputum is of great consequence in pthifical cases: and Bennet, in his "Theatrum Tabidorum," applies himself in a particular manner to it. The *sputum sanguinis* is a very dangerous symptom in that disease.

SPY, a person paid to watch the actions, motions, &c. of another, particularly as to what passes in an army.

The use of spies is a kind of clandestine practice or deceit in war. Spies are generally punished capitally, and immediately when they are discovered in a camp; and, says Vattel, not unjustly, there being scarcely any other way to prevent the mischief they may do. For this reason, a man of honour, who would not expose himself to die by the hand of a common executioner, ever declines serving as a spy; he counts it beneath him, as it can scarcely be done without some kind of treachery. The sovereign, therefore, cannot lawfully require such a service from his subjects, unless in some singular case, and that of the last importance. The mercenaries are allured to it by great rewards. If those whom a sovereign employs make a voluntary offer, or if they be not the enemy's subjects, or have no connection with him, he may unquestionably make use of their service, without offence to justice or honour; but it may be asked, is it lawful, is it decent, to solicit the enemy's subjects to act as spies, and betray him? Let the following paragraph serve as a reply.

If it be asked in general whether it be lawful to seduce the enemy's men, to engage them to transgress their duty by an infamous treachery? Here we must distinguish between what is due to the enemy, notwithstanding the state of the war, and what is required by the internal laws of conscience, and the rules of probity. Now the enemy may be weakened by all possible means, provided they do not affect the common safety of human society, as poison and assassination. The seducing a subject to turn spy, that of a governor to deliver up his place, does not strike at the foundation of the common safety and welfare of society. Subjects acting as the enemy's spies, are not a fatal and inevitable evil, they may in some measure be guarded against; and as to the security of fortresses, it is the sovereign's concern to choose proper governors. Thus these means are not contrary to the external law of nations, nor can the enemy complain of them as odious proceedings. Accordingly, they are practised in all wars. But are they just, and compatible with the laws of a pure conscience? Certainly not. And of this the generals themselves are sensible, as they are never heard to boast of having practised them. Seducing a subject to betray his country, suborning a traitor to set fire to a magazine, practising on the fidelity of a governor, enticing him, persuading him to deliver up a place, is prompting such persons to commit detestable crimes. Is it honest to incite our most inveterate enemy to be guilty of a crime? If such practices are at all excusable, it can be only in a very just war, and for saving our country, when threatened with ruin by a lawless conqueror. The guilt of a subject or general who betrays his prince in a cause manifestly unjust, does not appear so very odious. He who himself tramples upon justice and probity, deserves, in his turn, to feel the effects of perfidy and wickedness. And if ever it is excusable to depart from the strict rules of probity, it is against such an enemy, and in such an extremity. Vattel's Law of Nations, b. iii. ch. 10.

Wicquefort says, an ambassador is an honourable spy, under the protection of the law of nations.

SPYCKENS, in *Geography*, a town in the island of Voorn; 9 miles E. from the Brill.

SPYRUS, the *dung of goats*. This is usually found in small round masses, and is recommended by Hippocrates as a fumigation in the diseases of the womb.

SQUACCO, in *Ornithology*, the name of a large bird of the heron kind. Its head and neck are variegated with black, white, and yellow, and it has on the back part of its

head a crest of the same colour. Its back is of a ferruginous yellow, its breast and belly are white, as are also its wings and tail, at least in great part, and its legs are green. It is a bold and fierce bird.

SQUAD, in *Military Language*, a diminutive of Squadron; used to denote any small number of men, horse or foot, that are collected together for the purposes of drill, &c. See ESCOUADE.

Hence, to *squad* is to divide a troop or company into certain parts, in order to drill the men separately, or in small bodies, or to put them under the direction and care of some steady corporal, or lance corporal. Each troop ought to be divided into two squads, when under 40, and into three, or even four, when above this number, with an equal proportion of non-commissioned officers in each: and when the eldest is on duty, the charge of the squad falls on the next in the squad, and so on. Recruits should always be quartered and squadded with old soldiers, who are known to be steady and well behaved; and those men that are at all irregular in their conduct, must be separated and distributed in squads which are composed of good old soldiers.

SQUAD, *Aukward*, consists not only of recruits at drill, but of formed soldiers, that are ordered to exercise with them, in consequence of some irregularity under arms. The term has likewise been used, by way of ridicule or reproach, to mark out those officers who are negligent of their duty.

SQUADRON, a body of horse, whose number of men is not fixed, but is usually from eighty to a hundred and twenty men.

The word is formed from the Italian *squadrone*; of the Latin *squadro*, used by corruption for *quadro*: in regard, at first, the squadrons were always square, and called also by the Latins *agmina quadrata*.

The squadron usually consists of two troops, and each troop of about forty men; a greater number cannot be advantageously posted, nor have room to act in narrow grounds, woods, marshes, desiles, &c.

The eldest troop takes the right of the squadron, and the second the left.

SQUADRON of *Ships*, denotes either a detachment of ships employed on any particular expedition, or the third part of a naval armament.

The number of ships in a squadron is not fixed: a small number of vessels, if they be in a body, and have the same commander, may make a squadron.

If there be a great number, they are usually divided into three squadrons; and if the squadrons be numerous, each squadron is divided into three divisions, distinguished by their flags and colours. See DIVISION and FLEET.

SQUAIOTTA, in *Ornithology*, the name of a bird of the heron kind. Its beak is yellow, but blackish at the extremity; its legs are green; its head is variegated with grey and black; and its back very elegantly with white and red. It seems to have had its name from its note, which it often repeats in flying.

SQUAIL, in *Sea Language*, a sudden and violent blast of wind, usually occasioned by the interruption and reversion of the wind from high mountains. These are frequent in the Mediterranean, particularly in the Levant, as produced by the repulsion and new direction which the wind meets with in its passage between the various islands of the Archipelago. Falconer.

SQUAILLEY, a note of faultiness in the making of cloth. 43 Eliz. cap. 10. Blount. Cowel. See REWEY.

SQUALLY, in *Agriculture*, a term provincially applied to such crops of turnips, corn, rape, &c. as are broken or detached

detached by vacant or unproductive spots or patches. Crops which are thus produced have an extremely disagreeable appearance, and are never promising or productive to the farmer.

SQUALLY Land, a term sometimes applied to that sort of ground which is of the irregularly wet thin kind.

SQUALUS, the *Shark*, in *Ichthyology*, a genus of fishes of the order Chondropterigous, or, according to more modern naturalists, of the Cartilaginous order: the generic character is as follows. The mouth is situated beneath the anterior part of the head, with numerous teeth disposed in rows. On each side the neck, in most of the species, there are five spiracles of a femilar shape. The body is oblong, and somewhat cylindrical.

The animals of this genus are altogether marine; and are said to be rarer in the Baltic than in any other sea: they are viviparous, and are observed to produce more young at a time than the rays; but each is included, as is the case with those fishes, in a quadrangular capsule or involucrum, each extremity of which is extended into a long, contorted, cartilaginous thread of great length. Many of the sharks are said to emit a phosphoric light during the darkness of night: they are chiefly of a solitary nature, and, in general, devour, with the most indiscriminating voracity, almost every animal substance, whether living or dead. A few species are said to feed chiefly on fuci, and other marine vegetables. There are about thirty-four species enumerated by Gmelin, which are separated into different sections.

Species.

A. With temporal Orifice and anal Fin.

ISABELLA. The first dorsal fin is opposite the abdominal. It inhabits the southern Pacific ocean, and has been observed about the coasts of New Zealand. It is thirty inches long; in colour it is yellowish; the teeth are compressed, short, triangular, furnished on each side the base with a smaller lobe, and disposed in six rows; the tongue is very short and thick; the dorsal fin is subquadrangular; the second placed opposite the anal fin; the pectoral fins are very large; the ventral are separate, and pointed behind.

* **CANICULAR**; Spotted Dog-fish. Nostrils surrounded with a lobe and vermiform appendage; the ventral fins are distinct. This inhabits most seas, is about four or five feet long, is very voracious, and feeds chiefly on fish; the body is of a reddish-brown, with large distinct spots, which are black above, but white beneath, a little compressed at each end; the skin when dried is used for various purposes. The head is small; snout short; eyes oblong; pupil sea-green, iris white; the mouth is wide and oblong, with three rows of teeth; the tongue is cartilaginous, and with the palate rough; the vent is before the middle of the body; the first dorsal fin behind the ventral, the second less, and nearly opposite the anal; the tail is narrow, ending below in a sharp angle.

* **CATULUS**; Lesser Spotted Dog-fish. This species is specifically described as having nostrils covered with a lobe and vermiform appendage; the ventral fins are connected. It inhabits the Northern, Mediterranean, and Indian seas. Its habit is rather slender; in length it is from two to three feet; the head is large; snout prominent, and slightly pointed; the skin is rough; the body cylindrical; the colour pale brick-red, marked with very numerous, small, rounded, blackish or dusky spots; the abdomen is whitish; both the dorsal fins are placed much nearer to the tail than the head; the ventral fins are connate, large, and of a slightly pointed form; the anal fin is small; the tail is long, bilobate, with

the lower lobe continued to a considerable distance beneath. It is a most voracious fish. According to Mr. Pennant, it breeds from nine to thirteen young at a time; it is numerous on our own coasts, and very injurious to the fisheries. The liver, when taken or tasted as food, is highly noxious, causing a long-continued stupor, succeeded by a universal itching, with a total peeling off of the cuticle.

STELLARIS. Lobes of the nostrils double. This is found in the European ocean, and is from two to six feet long; it feeds chiefly on cruicaceous animals, molluscs, and lesser fish; the body is reddish, with unequal blackish spots; beneath it is of a dirty ash, and resembles the *S. canicula*, but the spots are larger and fewer; the snout is a little longer, the tail somewhat shorter, and the nostrils nearly closed; it brings forth about twenty at a time. The dorsal fins are equal; the first a little behind the middle of the body, the second a little behind the anal.

* **GALEUS**; Tope. Teeth nearly triangular, serrate on the inner edge. This species is of considerable size, often measuring several feet in length, though the specimens usually seen about the British coasts scarcely exceed the length of about five feet. In its habits it resembles the white SHARK (which see), being a very bold and rapacious fish, attacking such as happen to be accidentally exposed to it with great violence and rapidity; its shape is rather slender; its colour pale cinereous above, and whitish beneath; the nose is long, flat, and pointed; the nostrils are situated near the mouth, and behind each eye is a small orifice; the teeth are numerous, disposed in three rows, small, very sharp, triangular, and serrate on their inner edge. The first dorsal fin is placed about the middle of the back, and is rather large; the second is small, and situated near the tail, which is small, and terminates in two unequal lobes, of which the lower is the broadest. It has been alerted by able and well-informed naturalists, that this fish is so bold as to pursue its prey to the very edge of the shore, and even to attack those who are walking near the water's edge. It is supposed to be the fish mentioned by the name of *canicula*, which is described as highly dangerous to those employed in diving for corals, sponges, &c.

* **MUSTELUS**; Smooth Hound. The teeth of this species are very small and obtuse; it has short pectoral fins. The fish of this species are of a slender habit; their snouts are slightly sharpened, and lengthened; the first dorsal fin is large, and placed nearly in the middle of the back; the second nearly opposite the anal fin; the tail is shaped as in most others of this tribe, or slightly bilobate; the lower lobe is continued to some distance beneath; the teeth are very numerous, small, slightly convex, and set as in RAYS (which see.) The general colour of the animal is of a greyish-brown, paler or whiter beneath; sometimes varies in being marked above by numerous white spots. The stomach in this fish is furnished with several appendices, situated near the pylorus; it is found on our own coasts, and in other European seas, and also in the Indian sea, and when full grown it is about two feet long.

CIRRATUS. The nostrils have a worm-shaped appendage. This species inhabits the American and Pacific seas, and is from one to five feet long; the body is coated with large flat shining scales; when young it is spotted with black. The head is depressed; the snout is short, obtuse; the eyes and temporal orifice small; lips thick at the sides; teeth numerous, sharp, long, dilated at the base; the two hindmost spiracles are approximate; the vent is in the middle; the first dorsal fin is opposite the ventral; the anal is small; the tail is about a quarter as long as the body.

BARBATUS. The gape of the mouth is bearded with vermiform

SQUALUS.

vermiform appendages. It is found about the coasts of New Holland, and is from three to four feet long; the body is covered with small, hard, smooth shining scales, and marked with black spots, round and angular, surrounded with a white circle. The head is large, depressed, and short; the teeth are lanceolate, in many rows; cirri unequal, about an inch and a half long, and branched before. The temporal orifice is large; vent in the middle; first dorsal opposite the vent; the tail subdivided.

TIGRINUS. Tail elongated; the two hindmost spiracles are confluent. It inhabits the Indian ocean, and grows to the length of fifteen feet; the body is thick, oblong, black, with irregular white spots and bands; feeds on telluraceous animals and crabs. The head of this species is broad, flat, and sloping on the fore-part; the mouth transverse, with two cirri; the upper lip is thick and prominent; the teeth are minute, those on the upper jaw are moveable, and rough like a rasp; the tongue is thick, short; the eyes are small, oblong, and the pupil is blue; the iris is black; belly broad; pectoral fins short, broad; first dorsal opposite the ventral; the second is opposite the anal; the tail is compressed on each side, thin like a leaf at the end; the fin is long, and notched at the tip.

AFRICANUS. Body with several parallel, longitudinal, blackish bands above. This, as its specific name imports, is found in the African ocean, and is about two feet and a half long; the body is covered with minute subquadrate scales; above it is glaucous, beneath whitish.

OCELLATUS. On each side of the neck is a large, round, black blotch, surrounded with white. It inhabits the Pacific ocean and New Holland, is two feet and a half long; the body is long, cinereous, dotted; beneath it is of a greenish-ash colour.

ZYGÆNA. Head very broad, hammer-shaped. It inhabits the Mediterranean, American, and Indian seas; grows to six feet long, and to the weight of five hundred pounds; it is the most rapacious of all its tribe. See SHARK.

TIBURIO. The head is very broad, heart-shaped. It inhabits the South American seas. It very much resembles the last, except that the head, instead of being widened on each side into a long process, is rather subtriangular, and rounded off in front; the fins are glaucous.

GRISEUS. Spiracles six on each side. It inhabits the Mediterranean; is two feet and a half long; the body is of a mouse colour, a little rough; in the dried skin there is the appearance of small scales, with an elevated line in the middle.

VULPES; Sea-fox, or Long-tailed Shark. This species inhabits the Mediterranean sea, and often wanders on the British coasts; is seven feet long; the body above is of a blueish-ash colour; beneath it is paler; the scales are very minute. This is a very voracious fish. It is distinguished by its plump, short, subovate body, and very long tapering tail; the head is small and pointed; the first dorsal fin is triangular, and placed on the middle of the back; the second is set above the beginning of the tail, which gradually tapers to the tip, and is furnished with a shallow fin or process beneath, running from the base to the tip, which is sharp and slightly bilobate; the pectoral fins are of considerable size; the eyes are large; the mouth small; the teeth triangular, small, and disposed in three rows. The colour of the fish is dusky ash above, and whitish beneath. It grows to the length of thirteen or fourteen feet; the tail measures more than half the length of the whole animal. It is an inhabitant of the Mediterranean and other seas, and is considered as a voracious and artful fish; but the name of sea-fox is ap-

plied to it rather from the length of its tail than from its supposed sagacity.

LONGICAUDUS. Upper jaw with two cirri; the tail is long, as its specific name denotes; the head is obtuse; the nostrils near the mouth; there are four spiracles.

APPENDICULATUS; Botany Bay Shark. Upper jaw with two jagged, cartilaginous appendages, and four others on each side between the first and the spiracles. This inhabits New South Wales; is nineteen inches long; the body is brown, with three rows of large pale spots, dark within, rounded and nearly equal for half its length, and then growing suddenly very small. It is an extremely fierce animal. The head is broad, but angular; the mouth is placed near the end of the head; it has nine teeth in front, which are sharp, crooked, and in three rows, with a great number of small ones on each side; the eyes are projecting; dorsal fins placed far back; the pectoral near the spiracles; ventral near the middle of the body; the anal more than half way between the last and the tail, with a fin-like projection behind it to the end of the tail.

B. *With the anal Fin, but no temporal Orifice.*

* **GLAUCUS;** Blue Shark. The sides of the tail are smooth; the lower part of the back with a triangular dent. This is found in our own and almost all other seas. See SHARK.

* **CORNUBICUS;** Probeagle Shark. The snout of this species is projecting, sharp; body round, depressed and angulate near the tail. It inhabits the British coasts; is from three to four feet long; the body above is of a deep blue, beneath it is silvery; round, except near the tail, where it is depressed. This species is slightly described by Pennant, from an engraving which he found in Borlase's History of Cornwall, which was copied by Mr. Jago, who was esteemed a very observant and skilful ichthyologist. A specimen observed in 1793, on the coast of Hastings, is described in the third volume of the Linnæan Transactions. Its length from the tip of the snout to the extremity of the tail, was three feet ten inches; the colour of the body was a deep blue on the back, and white or silvery beneath; the shape was round, except for about six inches from the tail, where it was depressed; at about an inch from the tail was a semilunar or lunar impression, the points of which were towards the tail; where the body was depressed, the sides were raised into a sharp angle or elevated line, of about eight inches in length, running to the middle of the tail, or a little beyond; the nose was prominent, and sharp; and on either side, from the nose to the eyes, were numerous perforations or minute pores; the tail was of a lunar form, the upper lobe nearly a third longer than the lower.

* **CAMERICUS;** Beaumaris Shark. Snout short, blunt; body cylindrical, angulate near the tail. This is chiefly found on the British coasts; is seven feet long; very much resembles the last, except that it does not taper so much towards each end; the body is of a lead-colour, and smoothish.

CINEREUS. Seven spiracles on each side. It inhabits the Mediterranean; is three feet long; the body is glaucous, and a little rough.

* **MAXIMUS;** Basking Shark. Teeth conic, not ferrate. See SHARK.

* **CARCHARIAS;** White Shark. In this species the teeth are triangular. This is the most dreadful and voracious of all animals. See SHARK.

C. *With temporal Orifice, but no anal Fin.*

* **SPINOSUS.** Body covered over with large mucronate tubercles.

tubercles. This is about four feet in length; the colour is grey-brown above, whitish beneath; the body is roughened with scattered unequal tubercles, consisting of a broad round base, and curved, sharp-pointed tip; in some they are bifid; eyes large; snout prominent and conic; its gape is moderate; the teeth of a squarish shape, compressed, cornered at the margins, and placed in several rows; dorsal fins placed near the tail, the first opposite the ventral, which are set at an unusual distance from the head, and are almost as large as the pectoral; the tail is angular.

* *ACANTHIAS*; Picked Dog-fish. Dorsal fins spinous; the body is roundish; a variety has an ocellate body. This species inhabits most seas: it is about three feet and a half long; the body above is blackish, dotted sparingly with white; the sides are white, inclining to violet, with a few angulate transverse furrows, beneath white; the flesh is often salted and eaten.

JACKSONII. Eyes with a prominence over them on each side; before each of the dorsal fins is a strong spine. This inhabits Port Jackson, New Holland. It is not more than two feet long; the body is tapering, skin rough, above brown, beneath paler; the head is somewhat convex; teeth numerous, in many rows, larger as they are placed backwards, forming a bony plate.

SPINAX. Body beneath blackish. It is found in the Indian ocean; and, in its spinous back-fins, it very much resembles the last.

SQUAMOSUS. Body coated with small oblong scales. The body of this is three feet long, thick, round, resembling the next, except in having a longitudinal elevated line of scales down the middle.

CENTRINA. Body nearly triangular. It is from three to four feet in length; the body above is brown, carinate, beneath whitish, broad; skin covered with hard, erect tubercles; the flesh is very hard.

INDICUS. Back variegated, unarmed; teeth acute. It inhabits the Indian ocean.

AMERICANUS. Dorsal fins unarmed, the hinder one larger, ventral large near the tail. It is found in the South American seas; is three feet long; body round; scales small, angular.

* *SQUATINA*; Angel Fish. Pectoral fins very large, and notched on the fore-part. This species inhabits the Northern seas, and is from six to eight feet long; it feeds on lesser fish, and brings forth thirteen young at a time. The body above is cinereous, rough, with small recurved prickles; beneath it is smooth, white. In its shape it approaches very nearly to the Ray genus.

D. Without Teeth.

MASSASA. Pectoral fins long. An inhabitant of the Red sea.

KUMAL. Pectoral fins short; the mouth with four cirri. It inhabits the Red sea.

SQUALUS is also a name given by Varro, Columella, Salvia, and others, to a species of cyprinus, distinguished by Artedi by the name of the oblong cyprinus with long scales, and with the pinnae containing eleven rays, and commonly known with us under the name of *chub* or *chevin*.

The generality of authors call it *capito* and *cephalus*, but it is very improper to give distinct general names to fish, which are genuine species of other genera.

The name *squalus* is originally Latin: it is used by Pliny, and many other of the old Roman authors, and is derived from the word *squalor*, because this fish is found to delight in impure and dirty places.

SQUAM, in *Geography*, an American lake, partly situ-

ated in the township of Holderness in Grafton county, New Hampshire, and partly in Strafford county; about five miles long and four broad.—Also, a river of New Hampshire, the outlet of the above lake, which, after running a south-west course, joins the Pemigewasset, at the town of New Chester, 10 miles above the mouth of the Wine-piscogee branch.

SQUAM Beach, lies on the sea-coast of New Jersey, between Barnegat inlet and Cranberry new inlet.

SQUAM Harbour, lies on the north-east side of Cape Amen, in the state of Massachusetts. *Squam* (Pidgeon-hill) lies in N. lat. 42° 40'. W. long. 70° 36'.

SQUAMARIA, in *Botany*, from *squama*, a scale, in allusion to its scaly root, or subterraneous stem, is Rivinus's appellation for the Toothwort (see *LATHRÆA*); and is still used generically by Haller and Scopoli, though only specifically by Linnæus. The scales in question, bearing a great resemblance in every thing but hardness to the human fore-teeth, have given rise to the English name, and to that of *Dentaria*, used by Matthioli. But this plant must not be confounded with the Linnæan *DENTARIA*. See that article.

SQUAMIS, in *Ichthyology*, a name given by Albertus, and others, to the fish called by us the monk, or angel-fish, by the generality of authors *squatina*, and by the old Greek writers *rhine*. See *SQUALUS*.

SQUAMOSÆ Sutura Additamentum, in *Anatomy*, the portion of suture which connects the posterior inferior length of the parietal to the mastoid part of the temporal bone. See *CRANIUM*.

SQUAMOSE CULM, among *Botanists*. See *STALK*.

SQUAMOSE Root, one composed of, or covered with lesser flakes. See *ROOT*.

SQUAMOUS, in *Anatomy*, a suture of the head, made by the thin edge of one bone overlapping a corresponding thin edge of another.—Also, the portion of the temporal bone entering into the formation of the *squamosæ suture additamentum*. See *CRANIUM*.

SQUARCIONE, FRANCESCO, in *Biography*, a painter, born at Padua in 1394, more and better known as the founder of a school of art, than for any particular works of his own production. The school he maintained was furnished with designs and vestiges of antiquity, which he had acquired not only in Italy, but also in Greece, whither he travelled for the purpose; and it was at one time attended by upwards of 130 students, so that he acquired from it the respectable title of the father of the young painters. One picture of his is more particularly noticed by Lanzi, which was formerly in the church of the Carmelites at Padua, and afterwards in the private possession of the Conte de Lazara, representing St. Jerome surrounded by three saints; and he speaks of it in terms of praise for so early a production. It was painted, according to an inscription upon it, for the noble family of Lazara, in 1452, and is signed Francesco Squarcione. He died in 1474, at the age of 80.

SQUARE, QUADRATUM, in *Geometry*, a quadrilateral figure, whose angles are right, and sides equal.

SQUARE, To find the Area of *a*. Seek the length of one side; multiply this by itself; and the product is the area of the square. Thus, if the length of a side be 345, the area will be 119025; and if the side of a square be 10, the area will be 100.

Since, then, a decempeda contains 10 feet, a foot 10 digits, &c. a square decempeda contains 100 square feet, a square foot 100 square digits, &c.

SQUARE, the Properties of *a*, are, that its angles are all right, and, consequently, its sides perpendicular; that it is divided

divided into two equal parts, by a diagonal; that the diagonal of a square is incommensurable to the side.

SQUARES, for the Ratio of. They are to each other in the duplicate ratio of their sides. *E. gr.* a square whose side is double another, is quadruple of that other square.

SQUARE of the Cube.

SQUARE of the Surdefolid. } See POWER.

SQUARE Number, in Arithmetic and Algebra, is the product arising from multiplying any number by itself. Thus, $9 = 3 \cdot 3$, $16 = 4 \cdot 4$, $25 = 5 \cdot 5$, &c. are square numbers: and since, by the rules of algebra, $-3 \times -3 = 9$; $-4 \times -4 = 16$; $-5 \times -5 = 25$, &c.; it follows, that the square root of every positive number has two different roots; the one *plus*, or affirmative; the other *minus*, or negative; while the square root of every negative number is imaginary, or impossible.

Square numbers have several remarkable properties, of which the following are some of the most interesting, *viz.*

1. Every square number is of one of the forms $4n$ or $4n + 1$; that is, every square, when divided by 4, will leave either 0 or 1 for a remainder: and understanding this expression still in the same sense, the following table will express the forms of square numbers to the moduli, or divisors, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12.

Moduli.	Possible Forms of Squares.				
3	$3n$	$3n + 1$			
4	$4n$	$4n + 1$			
5	$5n$	$5n + 1$			
6	$6n$	$6n + 1$	$6n + 3$	$6n + 4$	
7	$7n$	$7n + 1$	$7n + 2$	$7n + 4$	
8	$8n$	$8n + 1$	$8n + 4$		
9	$9n$	$9n + 1$	$9n + 4$	$9n + 7$	
10	$10n$	$10n + 1$	$10n + 4$	$10n + 5$	
11	$11n$	$11n + 1$	$11n + 3$	$11n + 5$	$11n + 9$
12	$12n$	$12n + 1$	$12n + 4$	$12n + 9$	

2. And hence, by exclusion, we may derive the following table of impossible forms, *viz.*

Moduli.	Impossible Forms for Squares.				
3	$3n + 2$				
4	$4n + 2$	$4n + 3$			
5	$5n + 2$	$5n + 3$			
6	$6n + 2$	$6n + 5$			
7	$7n + 3$	$7n + 5$	$7n + 6$		
8	$8n + 2$	$8n + 3$	$8n + 7$		
9	$9n + 2$	$9n + 3$	$9n + 5$	$9n + 8$	
10	$10n + 2$	$10n + 3$			
11	$11n + 2$	$11n + 6$	$11n + 7$	$11n + 8$	$11n + 10$
12	$12n + 2$	$12n + 3$	$12n + 5$	$12n + 6$	$12n + 8$
	$12n + 10$				

These formulæ, as they involve no higher power of the indeterminate n than the first, are called *linear* forms; but, by means of them, we easily arrive at a variety of *quadratic* formulæ, which it is extremely useful to be acquainted with, in practising the Diophantine or indeterminate analysis.

If a person, unacquainted with these exclusions, were required to find two such numbers, that double the square of the one, added to triple the square of the other, should be

a square, he would see nothing impossible in the proposition, and might, therefore, lose many useless hours in the research; whereas, by a little attention to the impossible and possible forms, he would find the problem absolutely impossible, and hence spare himself much useless labour.

3. The method of deducing impossible quadratic forms from the linear ones above given, will be seen immediately from a single example. Let it be required to ascertain whether the equation, $2x^2 + 3y^2 = w^2$, be possible or impossible. First, we may assume x , y , and w , prime to each other; for if x and y have a common divisor, w must have the same, and the whole equation may be divided by it; whereby it will be reduced to another equation $2x'^2 + 3y'^2 = w'^2$, in which these quantities have no longer a common divisor, or, in other words, they are prime to each other.

Since, then, x and y are prime to each other, they cannot be both of the form $3n$; for, in this case, they would have a common divisor 3. Let then, first, x^2 be of the form $3n$, and y^2 of the form $3n + 1$; then $2x^2$ is of the form $3n'$, and $3y^2$ of the form $3n' + 3$, and consequently their sum will have the form $3n$, which is impossible, because, in this case, w and x would have a common divisor 3; and if we suppose x^2 of the form $3n + 1$, and y^2 of the form $3n$; then $2x^2 + 3y^2$ is of the form $3n + 2$, which is an impossible form: and, lastly, if we assume both of the form $3n + 1$, then $2x^2 + 3y^2$ would have again the same impossible form $3n + 2$; therefore, in no case can $2x^2 + 3y^2 = w^2$ be possible in integral numbers.

In the same manner a variety of other impossible forms may be deduced, of which the following are those which most commonly occur.

(5) *Modulus 3.*

$$2t^2 + 3u^2 = w^2$$

$$5t^2 + 3u^2 = w^2$$

$$8t^2 + 3u^2 = w^2$$

$$(3p + 2)t^2 + 3u^2 = w^2$$

(6) *Modulus 5.*

$$2p^2 \pm 5u^2 = w^2$$

$$3p^2 \pm 5u^2 = w^2$$

$$7t^2 \pm 5u^2 = w^2$$

$$(5p \pm 2)t^2 \pm 5u^2 = w^2$$

Or the two latter general forms may be rendered more comprehensive, by the introduction of another indeterminate q ; observing only that, in this case, the quantity must always be prime to the modulus. With this condition, the two latter may be written thus:

$$(3p + 2)t^2 + 3qu^2 = w^2, \text{ and}$$

$$(5p \pm 2)t^2 \pm 5qu^2 = w^2.$$

(7) *Modulus 7.*

$$(7p + 3)t^2 \pm 7qu^2 = w^2$$

$$(7p + 5)t^2 \pm 7qu^2 = w^2$$

$$(7p + 6)t^2 \pm 7qu^2 = w^2$$

(8) *Modulus 11.*

$$(11p + 2)t^2 \pm 11qu^2 = w^2$$

$$(11p + 6)t^2 \pm 11qu^2 = w^2$$

$$(11p + 7)t^2 \pm 11qu^2 = w^2$$

(9) *Modulus 13.*

$$(13p \pm 2)t^2 \pm 13qu^2 = w^2$$

$$(13p \pm 5)t^2 \pm 13qu^2 = w^2$$

$$(13p \pm 6)t^2 \pm 13qu^2 = w^2$$

$$(13p \pm 7)t^2 \pm 13qu^2 = w^2$$

SQUARE NUMBERS.

(10) *Modulus 17.*

$$\begin{aligned} (17p \pm 3) t^1 \pm 17qu^2 &= w^2 \\ (17p \pm 5) t^2 \pm 17qu^2 &= w^2 \\ (17p \pm 6) t^1 \pm 17qu^2 &= w^2 \\ (17p \pm 7) t^2 \pm 17qu^2 &= w^2 \end{aligned}$$

A great variety of impossible forms might have been given to other moduli; but the above are sufficient for our present purpose.

There are also many formulæ, which, though possible singly, become impossible in pairs: such are the following:

$$\begin{aligned} 11. \begin{cases} x^2 + y^2 = z^2 \\ x^2 - y^2 = w^2 \end{cases} & 12. \begin{cases} x^2 + y^2 = 2w^2 \\ x^2 - y^2 = 2z^2 \end{cases} \\ 13. \begin{cases} 2x^2 + y^2 = z^2 \\ 2x^2 - y^2 = w^2 \end{cases} & 14. \begin{cases} x^2 + 2y^2 = 2z^2 \\ x^2 - 2y^2 = 2w^2 \end{cases} \\ 15. \begin{cases} x^2 + 2y^2 = z^2 \\ x^2 - 2y^2 = w^2 \end{cases} & 16. \begin{cases} 2x^2 + y^2 = 2z^2 \\ 2x^2 - y^2 = 2w^2 \end{cases} \end{aligned}$$

These might also be carried to a much greater extent, and many collateral properties drawn from them relative to the impossibility of some higher powers: we must not, however, carry the subject farther in this place. The reader, who is desirous of more detailed information, may consult Barlow's "Elementary Investigation of the Theory of Numbers," where this part of the doctrine of numbers is carried to a considerable extent. We shall merely select a few other distinct properties of squares, as they are given by the same author, in his "Mathematical Dictionary."

17. The sum of two odd squares cannot be a square.

18. An odd square, taken from an even square, cannot leave a square remainder.

19. If the sum of two squares be itself a square, one of the three squares is divisible by 5.

20. Square numbers must terminate in one of the digits 0, 1, 4, 5, 6, or 9.

21. No number of repetend digits can be a square.

22. The area of a rational right-angled triangle cannot be equal to a square.

23. The two following series are remarkable for being such, as, when reduced to improper fractions, the sum of the squares of each numerator and denominator is a complete square; or, which is the same, they are the sides of rational right-angled triangles. These series are as follows, *viz.*

$$\begin{aligned} 1\frac{1}{2}, 2\frac{3}{5}, 3\frac{3}{7}, 4\frac{4}{9}, 5\frac{5}{11}, \&c. \&c. \\ 1\frac{1}{4}, 2\frac{1}{2}, 3\frac{1}{4}, 4\frac{1}{2}, 5\frac{3}{4}, \&c. \&c. \end{aligned}$$

24. The second differences of consecutive square numbers are equal to each other, thus:

Squares	1, 4, 9, 16, 25, &c.
First difference	3, 5, 7, 9, &c.
Second difference	2, 2, 2, &c.

To these we may also add the following; which are more particularly applicable to the indeterminate and Diophantine analysis.

25. If a number be the sum of two squares, its double is also the sum of two squares; for

$$(x^2 + y^2) \times 2 = (x + y)^2 + (x - y)^2.$$

Hence also, the sum of two squares multiplied by any power of 2, is the sum of two squares.

26. The product of two numbers, each being the sum of two squares, is itself the sum of two squares; for

$$\begin{aligned} (x^2 + y^2) \times (x'^2 + y'^2) &= \\ \{ (xx' + yy')^2 + (xy' - x'y)^2, \text{ or} \\ \{ (xx' - yy')^2 + (xy' + x'y)^2 \end{aligned}$$

$$\text{Thus, } \begin{array}{l} 5 = 2^2 + 1^2 \\ 13 = 3^2 + 2^2 \end{array}$$

$$\text{Product } 65 = 8^2 + 1^2 \text{ or } 7^2 + 4^2$$

27. The product of the sum of four squares, by the sum of four other squares, is itself the sum of four squares; thus

$$\begin{aligned} (w^2 + x^2 + y^2 + z^2) \times (w'^2 + x'^2 + y'^2 + z'^2) &= \\ \{ (ww' + xx' + yy' + zz')^2 + (wx' - xw' & \\ \quad + yz' - y'z)^2 + & \\ \{ (y'w - xz' - yw' + xz')^2 + (wx' + xy' & \\ \quad - yx' - xw')^2 \} & \end{aligned}$$

as will appear by the development of these formulæ.

28. Every integral number is either a square, or the sum of two, three, or four squares.

The latter is one of the celebrated numerical theorems of Fermat, which was first demonstrated by Lagrange.

For a variety of other properties, see the works above referred to.

We shall conclude this article with a table of the squares and cubes of all numbers from 1 to 1200. A table of the square and cube roots, to the same extent, is given under the article Root.

SQUARE NUMBERS.

TABLE of Squares and Cubes to 1200.

No.	Squares.	Cubes.	No.	Squares.	Cubes.	No.	Squares.	Cubes.	No.	Squares.	Cubes.
1	1	1	61	3721	226981	121	14641	1771561	181	32761	5929741
2	4	8	62	3844	238328	122	14884	1815848	182	33124	6028568
3	9	27	63	3969	250047	123	15129	1860867	183	33489	6128487
4	16	64	64	4096	262144	124	15376	1906624	184	33856	6229504
5	25	125	65	4225	274625	125	15625	1953125	185	34225	6331625
6	36	216	66	4356	287496	126	15876	2000376	186	34596	6434856
7	49	343	67	4489	300763	127	16129	2048383	187	34969	6539203
8	64	512	68	4624	314432	128	16384	2097152	188	35344	6644672
9	81	729	69	4761	328509	129	16641	2146689	189	35721	6751269
10	100	1000	70	4900	343000	130	16900	2197000	190	36100	6859000
11	121	1331	71	5041	357911	131	17161	2248091	191	36481	6967871
12	144	1728	72	5184	373248	132	17424	2299968	192	36864	7077888
13	169	2197	73	5329	389017	133	17689	2352637	193	37249	7189057
14	196	2744	74	5476	405424	134	17956	2406104	194	37636	7301384
15	225	3375	75	5625	421875	135	18225	2460375	195	38025	7414875
16	256	4096	76	5776	438976	136	18496	2515456	196	38416	7529536
17	289	4913	77	5929	456533	137	18769	2571353	197	38809	7645373
18	324	5832	78	6084	474552	138	19044	2628072	198	39204	7762392
19	361	6859	79	6241	493039	139	19321	2685619	199	39601	7880599
20	400	8000	80	6400	512000	140	19600	2744000	200	40000	8000000
21	441	9261	81	6561	531441	141	19881	2803221	201	40401	8120601
22	484	10648	82	6724	551368	142	20164	2863288	202	40804	8242408
23	529	12167	83	6889	571787	143	20449	2924207	203	41209	8365427
24	576	13824	84	7056	592704	144	20736	2985984	204	41616	8489664
25	625	15625	85	7225	614125	145	21025	3048625	205	42025	8615125
26	676	17576	86	7396	636056	146	21316	3112136	206	42436	8741816
27	729	19683	87	7569	658503	147	21609	3176523	207	42849	8869743
28	784	21952	88	7744	681472	148	21904	3241792	208	43264	8998912
29	841	24389	89	7921	704969	149	22201	3307949	209	43681	9129329
30	900	27000	90	8100	729000	150	22500	3375000	210	44100	9261000
31	961	29791	91	8281	753571	151	22801	3442951	211	44521	9393931
32	1024	32768	92	8464	778688	152	23104	3511808	212	44944	9528128
33	1089	35937	93	8649	804357	153	23409	3581577	213	45369	9663597
34	1156	39304	94	8836	830584	154	23716	3652264	214	45796	9800344
35	1225	42875	95	9025	857375	155	24025	3723875	215	46225	9938375
36	1296	46656	96	9216	884736	156	24336	3796416	216	46656	10077696
37	1369	50653	97	9409	912673	157	24649	3869893	217	47089	10218313
38	1444	54872	98	9604	941192	158	24964	3944312	218	47524	10360232
39	1521	59319	99	9801	970299	159	25281	4019679	219	47961	10503459
40	1600	64000	100	10000	1000000	160	25600	4096000	220	48400	10648000
41	1681	68921	101	10201	1030301	161	25921	4173281	221	48841	10793861
42	1764	74088	102	10404	1061208	162	26244	4251528	222	49284	10941048
43	1849	79507	103	10609	1092727	163	26569	4330747	223	49729	11089567
44	1936	85184	104	10816	1124864	164	26896	4410944	224	50176	11239424
45	2025	91125	105	11025	1157625	165	27225	4492125	225	50625	11390625
46	2116	97336	106	11236	1191016	166	27556	4574296	226	51076	11543176
47	2209	103823	107	11449	1225043	167	27889	4657463	227	51529	11697083
48	2304	110592	108	11664	1259712	168	28224	4741632	228	51984	11852352
49	2401	117649	109	11881	1295029	169	28561	4826809	229	52441	12008989
50	2500	125000	110	12100	1331000	170	28900	4913000	230	52900	12167000
51	2601	132651	111	12321	1367631	171	29241	5000211	231	53361	12326391
52	2704	140608	112	12544	1404928	172	29584	5088448	232	53824	12487168
53	2809	148877	113	12769	1442897	173	29929	5177717	233	54289	12649337
54	2916	157464	114	12996	1481544	174	30276	5268024	234	54756	12812904
55	3025	166375	115	13225	1520875	175	30625	5359375	235	55225	12977875
56	3136	175616	116	13456	1560896	176	30976	5451776	236	55696	13144256
57	3249	185193	117	13689	1601613	177	31329	5545233	237	56169	13312053
58	3364	195112	118	13924	1643032	178	31684	5639752	238	56644	13481272
59	3481	205379	119	14161	1685159	179	32041	5735339	239	57121	13651919
60	3600	216000	120	14400	1728000	180	32400	5832000	240	57600	13824000

SQUARE NUMBERS.

TABLE of Squares and Cubes to 1200.

No.	Squares.	Cubes.	No.	Squares.	Cubes.	No.	Squares.	Cubes.	No.	Squares.	Cubes.
241	58081	13997521	301	90601	27270901	361	130321	47045881	421	177241	74618461
242	58564	14172488	302	91204	27543608	362	131044	47437928	422	178084	75151448
243	59049	14348907	303	91809	27818127	363	131769	47832147	423	178929	75686967
244	59536	14526784	304	92416	28094464	364	132496	48228544	424	179776	76225024
245	60025	14706125	305	93025	28372625	365	133225	48627125	425	180625	76765625
246	60516	14886936	306	93636	28652616	366	133956	49027896	426	181476	77308776
247	61009	15069223	307	94249	28934443	367	134689	49430863	427	182329	77854483
248	61504	15252992	308	94864	29218112	368	135424	49836032	428	183184	78402752
249	62001	15438249	309	95481	29503629	369	136161	50243409	429	184041	78953589
250	62500	15625000	310	66100	29791000	370	136900	50653000	430	184900	79507000
251	63001	15813251	311	96721	30080231	371	137641	51064811	431	185761	80062991
252	63504	16003008	312	97344	30371328	372	138384	51478849	432	186624	80621568
253	64009	16194277	313	97969	30664297	373	139129	51895117	433	187489	81182737
254	64516	16387064	314	98596	30959144	374	139876	52313624	434	188356	81746504
255	65025	16581375	315	99225	31255875	375	140625	52734375	435	189225	82312875
256	65536	16777216	316	99856	31554496	376	141376	53157376	436	190096	82881856
257	66049	16974593	317	100489	31855013	377	142129	53582633	437	190969	83453453
258	66564	17173512	318	101124	32157432	378	142884	54010152	438	191844	84027672
259	67081	17373979	319	101761	32461759	379	143641	54437939	439	192721	84604519
260	67600	17576000	320	102400	32768000	380	144400	54872000	440	193600	85184000
261	68121	17779581	321	103041	33076161	381	145161	55306341	441	194481	85766121
262	68644	17984728	322	103684	33386248	382	145924	55742968	442	195364	86350888
263	69169	18191447	323	104329	33698267	383	146689	56181887	443	196249	86938307
264	69696	18399744	324	104976	34012224	384	147456	56623104	444	197136	87528384
265	70225	18609625	325	105625	34328125	385	148225	57066625	445	198025	88121125
266	70756	18821096	326	106276	34645976	386	148996	57512456	446	198916	88716536
267	71289	19034163	327	106929	34965783	387	149769	57960603	447	199809	89314623
268	71824	19248832	328	107584	35287552	388	150544	58411072	448	200704	89915392
269	72361	19465109	329	108241	35611289	389	151321	58863869	449	201601	90518849
270	72900	19683000	330	108900	35937000	390	152100	59319000	450	202500	91125000
271	73441	19902511	331	109561	36264691	391	152881	59776471	451	203401	91733851
272	73984	20123648	332	110224	36594368	392	153664	60236288	452	204304	92345408
273	74529	20346417	333	110889	36926037	393	154449	60698457	453	205209	92959677
274	75076	20570824	334	111556	37259704	394	155236	61162984	454	206116	93576664
275	75625	20796875	335	112225	37595375	395	156025	61629875	455	207025	94196375
276	76176	21024576	336	112896	37933056	396	156816	62099136	456	207936	94818816
277	76729	21253933	337	113569	38272753	397	157609	62570773	457	208849	95443993
278	77284	21484952	338	114244	38614472	398	158404	63044792	458	209764	96071912
279	77841	21717639	339	114921	38958219	399	159201	63521199	459	210681	96702579
280	78400	21952000	340	115600	39304000	400	160000	64000000	460	211600	97336000
281	78961	22188041	341	116281	39651821	401	160801	64481201	461	212521	97972181
282	79524	22425768	342	116964	40001688	402	161604	64964808	462	213444	98611128
283	80089	22665187	343	117649	40353697	403	162409	65450827	463	214369	99252847
284	80656	22906304	344	118336	40707584	404	163216	65939264	464	215296	99897344
285	81225	23149125	345	119025	41063625	405	164025	66430125	465	216225	100544625
286	81796	23393656	346	119716	41421736	406	164836	66923416	466	217156	101194696
287	82369	23639903	347	120409	41781923	407	165649	67419143	467	218089	101847563
288	82944	23887872	348	121104	42144192	408	166464	67917312	468	219024	102503232
289	83521	24137569	349	121801	42508549	409	167281	68417929	469	219961	103161709
290	84100	24389000	350	122500	42875000	410	168100	68921000	470	220900	103823000
291	84681	24642171	351	123201	43243551	411	168921	69426531	471	221841	104487111
292	85264	24897088	352	123904	43614208	412	169744	69934528	472	222784	105154048
293	85849	25153757	353	124609	43986977	413	170569	70444997	473	223729	105823817
294	86436	25412184	354	125316	44361864	414	171396	70957944	474	224676	106496424
295	87025	25672375	355	126025	44738875	415	172225	71473375	475	225625	107171875
296	87616	25934336	356	126736	45118016	416	173056	71991296	476	226576	107850176
297	88209	26198073	357	127449	45499293	417	173889	72511713	477	227529	108531333
298	88804	26463592	358	128164	45882712	418	174724	73034632	478	228484	109215352
299	89401	26730899	359	128881	46268279	419	175561	73560059	479	229441	109902239
300	90000	27000000	360	129600	46656000	420	176400	74088000	480	230400	110592000

SQUARE NUMBERS.

TABLE of Squares and Cubes to 1200.

No.	Squares.	Cubes.	No.	Squares.	Cubes.	No.	Squares.	Cubes.	No.	Squares.	Cubes.
481	231361	111284641	541	292681	158340421	601	361201	217081801	661	436921	288804781
482	232324	111980168	542	293764	159220088	602	362404	218167208	662	438244	290117528
483	233289	112678587	543	294849	160103007	603	363609	219256227	663	439569	291434247
484	234256	113379904	544	295936	160989184	604	364816	220348864	664	440896	292754944
485	235225	114084125	545	297025	161878625	605	366025	221445125	665	442225	294079625
486	236196	114791256	546	298116	162771336	606	367236	222545016	666	443556	295408296
487	237169	115501303	547	299209	163666323	607	368449	223648543	667	444889	296740963
488	238144	116214272	548	300304	164566592	608	369664	224755712	668	446224	298077632
489	239121	116930169	549	301401	165469149	609	370881	225866529	669	447561	299418309
490	240100	117649000	550	302500	166375000	610	372100	226981000	670	448900	300763000
491	241081	118370771	551	303601	167284151	611	373321	228099131	671	450241	302111711
492	242064	119095488	552	304704	168196608	612	374544	229220928	672	451584	303464448
493	243049	119823157	553	305809	169112377	613	375769	230346397	673	452929	304821217
494	244036	120553784	554	306916	170031464	614	376996	231475544	674	454276	306182024
495	245025	121287375	555	308025	170953875	615	378225	232608375	675	455625	307546875
496	246016	122023936	556	309136	171879616	616	379456	233744896	676	456976	308915776
497	247009	122763473	557	310249	172808693	617	380689	234885113	677	458329	310288733
498	248004	123505992	558	311364	173741112	618	381924	236029032	678	459684	311665752
499	249001	124251499	559	312481	174676879	619	383161	237176659	679	461041	313046839
500	250000	125000000	560	313600	175616000	620	384400	238328000	680	462400	314432000
501	251001	125751501	561	314721	176558481	621	385641	239483061	681	463761	315821241
502	252004	126506008	562	315844	177504328	622	386884	240641848	682	465124	317214568
503	253009	127263527	563	316969	178453547	623	388129	241804367	683	466489	318611987
504	254016	128024064	564	318096	179406144	624	389376	242970624	684	467856	320013504
505	255025	128787625	565	319225	180362125	625	390625	244140625	685	469225	321419125
506	256036	129554216	566	320356	181321496	626	391876	245314376	686	470596	322828856
507	257049	130323843	567	321489	182284263	627	393129	246491883	687	471969	324242703
508	258064	131096512	568	322624	183250432	628	394384	247673152	688	473344	325660672
509	259081	131872229	569	323761	184220039	629	395641	248858189	689	474721	327082769
510	260100	132651000	570	324900	185193000	630	396900	250047000	690	476100	328509000
511	261121	133432831	571	326041	186169411	631	398161	251239591	691	477481	329939371
512	262144	134217728	572	327184	187149248	632	399424	252435968	692	478864	331373888
513	263169	135005697	573	328329	188132517	633	400689	253636137	693	480249	332812557
514	264196	135796744	574	329476	189119224	634	401956	254840104	694	481636	334255384
515	265225	136590875	575	330625	190109375	635	403225	256047875	695	483025	335702375
516	266256	137388096	576	331776	191102976	636	404496	257259456	696	484416	337153536
517	267289	138188413	577	332929	192100033	637	405769	258474853	697	485809	338608873
518	268324	138991832	578	334084	193100552	638	407044	259694072	698	487204	340068392
519	269361	139798359	579	335241	194104539	639	408321	260917119	699	488601	341532099
520	270400	140608000	580	336400	195112000	640	409600	262144000	700	490000	343000000
521	271441	141420761	581	337561	196122941	641	410881	263374721	701	491401	344472101
522	272484	142236648	582	338724	197137368	642	412164	264609288	702	492804	345948408
523	273529	143055667	583	339889	198155287	643	413449	265847707	703	494209	347428927
524	274576	143877824	584	341056	199176704	644	414736	267089984	704	495616	348913664
525	275625	144703125	585	342225	200201625	645	416025	268336125	705	497025	350402625
526	276676	145531576	586	343396	201230056	646	417316	269586136	706	498436	351895816
527	277729	146363183	587	344569	202262003	647	418609	270840023	707	499849	353393243
528	278784	147197952	588	345744	203297472	648	419904	272097792	708	501264	354894912
529	279841	148035889	589	346921	204336469	649	421201	273359449	709	502681	356400829
530	280900	148877000	590	348100	205379000	650	422500	274625000	710	504100	357911000
531	281961	149721291	591	349281	206425071	651	423801	275894451	711	505521	359425431
532	283024	150568768	592	350464	207474688	652	425104	277167808	712	506944	360944128
533	284089	151419437	593	351649	208527857	653	426409	278445077	713	508369	362467097
534	285156	152273304	594	352836	209584884	654	427716	279726264	714	509796	363994344
535	286225	153130375	595	354025	210644875	655	429025	281011375	715	511225	365525875
536	287296	153990656	596	355216	211708736	656	430336	282300416	716	512656	367061696
537	288369	154854153	597	356409	212776173	657	431649	283593393	717	514089	368601813
538	289444	155720872	598	357604	213847192	658	432964	284890312	718	515524	370146232
539	290521	156590819	599	358801	214921799	659	434281	286191179	719	516961	371694959
540	291600	157464000	600	360000	216000000	660	435600	287496000	720	518400	373248000

SQUARE NUMBERS.

TABLE of Squares and Cubes to 1200.

No.	Squares.	Cubes.	No.	Squares.	Cubes.	No.	Squares.	Cubes.	No.	Squares.	Cubes.
721	519841	374805361	781	609961	476379541	841	707281	594823321	901	811801	731432701
722	521284	376367048	782	611524	478211768	842	708964	596947688	902	813604	733870808
723	522729	377933067	783	613089	480048687	843	710649	599077107	903	815409	736314327
724	524176	379503424	784	614656	481890304	844	712336	601211584	904	817216	738763264
725	525625	381078125	785	616225	483736625	845	714025	603351125	905	819025	741217625
726	527076	382657176	786	617796	485587656	846	715716	605495736	906	820836	743677416
727	528529	384240583	787	619369	487443403	847	717409	607645423	907	822649	746142643
728	529984	385828352	788	620944	489303872	848	719104	609800192	908	824464	748613312
729	531441	387420489	789	622521	491169069	849	720801	611960049	909	826281	751089429
730	532900	389017000	790	624100	493039000	850	722500	614125000	910	828100	753571000
731	534361	390617891	791	625681	494913671	851	724201	616295051	911	829921	756058031
732	535824	392223168	792	627264	496793088	852	725904	618470208	912	831744	758550528
733	537289	393832837	793	628849	498677257	853	727609	620650477	913	833569	761048497
734	538756	395446904	794	630436	500566184	854	729316	622835864	914	835396	763551944
735	540225	397065375	795	632025	502459875	855	731025	625026375	915	837225	766060875
736	541696	398688256	796	633616	504358336	856	732736	627222016	916	839056	768575296
737	543169	400315553	797	635209	506261573	857	734449	629422793	917	840889	771095213
738	544644	401947272	798	636804	508169592	858	736164	631628712	918	842724	773620632
739	546121	403583419	799	638401	510082399	859	737881	633838779	919	844561	776151559
740	547600	405224000	800	640000	512000000	860	739600	636056000	920	846400	778688000
741	549081	406869021	801	641601	513922401	861	741321	638277381	921	848241	781229961
742	550564	408518488	802	643204	515849608	862	743044	640503928	922	850084	783777448
743	552049	410172407	803	644809	517781627	863	744769	642735647	923	851929	786330467
744	553536	411830784	804	646416	519718464	864	746496	644972544	924	853776	788889024
745	555025	413493625	805	648025	521660125	865	748225	647214625	925	855625	791453125
746	556516	415160936	806	649636	523606616	866	749956	649461896	926	857476	794022776
747	558009	416832723	807	651249	525557943	867	751689	651714363	927	859329	796597983
748	559504	418508992	808	652864	527514112	868	753424	653972032	928	861184	799178752
749	561001	420189749	809	654481	529475119	869	755161	656234909	929	863041	801765089
750	562500	421875000	810	656100	531441000	870	756900	658503000	930	864900	804357000
751	564001	423564751	811	657721	533411731	871	758641	660776311	931	866761	806954491
752	565504	425259008	812	659344	535387328	872	760384	663054848	932	868624	809557568
753	567009	426957777	813	660969	537367797	873	762129	665338617	933	870489	812166237
754	568516	428661064	814	662596	539353144	874	763876	667627624	934	872356	814780504
755	570025	430368875	815	664225	541343375	875	765625	669921875	935	874225	817400375
756	571536	432081216	816	665856	543338496	876	767376	672221376	936	876096	820025856
757	573049	433798093	817	667489	545338513	877	769129	674526133	937	877969	822656953
758	574564	435519512	818	669124	547343432	878	770884	676836152	938	879844	825293672
759	576081	437245479	819	670761	549353259	879	772641	679151439	939	881721	827936019
760	577600	438976000	820	672400	551368000	880	774400	681472000	940	883600	830584000
761	579121	440711081	821	674041	553387661	881	776161	683797841	941	885481	833237621
762	580644	442450728	822	675684	555412248	882	777924	686128968	942	887364	835896888
763	582169	444194947	823	677329	557441767	883	779689	688465387	943	889249	838561807
764	583696	445943744	824	678976	559476224	884	781456	690807104	944	891136	841232384
765	585225	447697125	825	680625	561515625	885	783225	693154125	945	893025	843908625
766	586756	449455096	826	682276	563559976	886	784996	695506456	946	894916	846590536
767	588289	451217663	827	683929	565609283	887	786769	697864103	947	896809	849278813
768	589824	452984832	828	685584	567663552	888	788544	700227072	948	898704	851971392
769	591361	454756609	829	687241	569722789	889	790321	702595369	949	900601	854670349
770	592900	456533000	830	688900	571787000	890	792100	704969000	950	902500	857375000
771	594441	458314011	831	690561	573856191	891	793881	707347971	951	904401	860085351
772	595984	460099648	832	692224	575930368	892	795664	709732288	952	906304	862801408
773	597529	461889917	833	693889	578009537	893	797449	712121957	953	908209	865523177
774	599076	463684824	834	695556	580093704	894	799236	714516984	954	910116	868250664
775	600625	465484375	835	697225	582182875	895	801025	716917375	955	912025	870983875
776	602176	467288576	836	698896	584277056	896	802816	719323136	956	913936	873722816
777	603729	469097433	837	700569	586376253	897	804609	721734273	957	915849	876467943
778	605284	470910952	838	702244	588480472	898	806404	724150792	958	917764	879217912
779	606841	472729139	839	703921	590589719	899	808201	726572699	959	919681	881974079
780	608400	474552000	840	705600	592704000	900	810000	729000000	960	921600	884736000

SQUARE NUMBERS.

TABLE of Squares and Cubes to 1200.

No.	Squares.	Cubes.	No.	Squares.	Cubes.	No.	Squares.	Cubes.	No.	Squares.	Cubes.
961	923521	887503681	1021	1042441	1064332261	1081	1168561	1263214441	1141	1301881	1485446221
962	925444	890277128	1022	1044484	1067462648	1082	1170724	1266723368	1142	1304164	1489355288
963	927369	893056347	1023	1046529	1070599167	1083	1172889	1270238787	1143	1306449	1493271207
964	929296	895841344	1024	1048576	1073741824	1084	1175056	1273760704	1144	1308736	1497193984
965	931225	898632125	1025	1050625	1076890625	1085	1177225	1277289125	1145	1311025	1501123625
966	933156	901428696	1026	1052676	1080045576	1086	1179396	1280824056	1146	1313316	1505060136
967	935089	904231063	1027	1054729	1083206683	1087	1181569	1284365503	1147	1315609	1509000523
968	937024	907039232	1028	1056784	1086373952	1088	1183744	1287913472	1148	1317904	1512953792
969	938961	909853209	1029	1058841	1089547389	1089	1185921	1291467969	1149	1320201	1516910949
970	940900	912673000	1030	1060900	1092727000	1090	1188100	1295029000	1150	1322500	1520875000
971	942841	915498611	1031	1062961	1095912791	1091	1190281	1298596571	1151	1324801	1524845951
972	944784	918330048	1032	1065024	1099104768	1092	1192464	1302170688	1152	1327104	1528823808
973	946729	921167317	1033	1067089	1102302937	1093	1194649	1305751357	1153	1329409	1532808577
974	948676	924010424	1034	1069156	1105507304	1094	1196836	1309338584	1154	1331716	1536800264
975	950625	926859375	1035	1071225	1108717875	1095	1199025	1312932375	1155	1334025	1540798875
976	952576	929714176	1036	1073296	1111934656	1096	1201216	1316532736	1156	1336336	1544804416
977	954529	932574833	1037	1075369	1115157653	1097	1203409	1320139673	1157	1338649	1548816893
978	956484	935441352	1038	1077444	1118386872	1098	1205604	1323753192	1158	1340964	1552836312
979	958441	938313739	1039	1079521	1121622319	1099	1207801	1327373299	1159	1343281	1556862679
980	960400	941192000	1040	1081600	1124864000	1100	1210000	1331000000	1160	1345600	1560896000
981	962361	944076141	1041	1083681	1128111921	1101	1212201	1334633301	1161	1347921	1564936281
982	964324	946966168	1042	1085764	1131366088	1102	1214404	1338273208	1162	1350244	1568983528
983	966289	949862087	1043	1087849	1134626507	1103	1216609	1341919727	1163	1352569	1573037747
984	968256	952763904	1044	1089936	1137893184	1104	1218816	1345572864	1164	1354896	1577098944
985	970225	955671625	1045	1092025	1141166125	1105	1221025	1349232625	1165	1357225	1581167125
986	972196	958585256	1046	1094116	1144445336	1106	1223236	1352899016	1166	1359556	1585242296
987	974169	961504803	1047	1096209	1147733083	1107	1225449	1356572043	1167	1361889	1589324463
988	976144	964430272	1048	1098304	1151022592	1108	1227664	1360251712	1168	1364224	1593413632
989	978121	967361669	1049	1100401	1154320649	1109	1229881	1363933809	1169	1366561	1597509809
990	980100	970299000	1050	1102500	1157625000	1110	1232100	1367631000	1170	1368900	1601613000
991	982081	973242271	1051	1104601	1160935651	1111	1234321	1371330631	1171	1371241	1605723211
992	984064	976191488	1052	1106704	1164252688	1112	1236544	1375036928	1172	1373584	1609840488
993	986049	979146657	1053	1108809	1167575877	1113	1238769	1378749897	1173	1375929	1613964717
994	988036	982107784	1054	1110916	1170905464	1114	1240996	1382469544	1174	1378276	1618096024
995	990025	985074875	1055	1113025	1174241375	1115	1243225	1386195875	1175	1380625	1622234375
996	992016	988047936	1056	1115136	1177583616	1116	1245456	1389928896	1176	1382976	1626379776
997	994009	991026973	1057	1117249	1180932193	1117	1247689	1393668613	1177	1385329	1630532233
998	996004	994011992	1058	1119364	1184287112	1118	1249924	1397415032	1178	1387684	1634691752
999	998001	997002999	1059	1121481	1187648379	1119	1252161	1401168159	1179	1390041	1638858339
1000	1000000	1000000000	1060	1123600	1191016000	1120	1254400	1404928000	1180	1392400	1643032000
1001	1002001	1003003001	1061	1125721	1194389981	1121	1256641	1408694561	1181	1394761	1647212741
1002	1004004	1006012008	1062	1127844	1197770328	1122	1258884	1412467848	1182	1397124	1651400568
1003	1006009	1009027027	1063	1129969	1201157047	1123	1261129	1416247867	1183	1399489	1655595487
1004	1008016	1012048064	1064	1132096	1204550144	1124	1263376	1420034624	1184	1401856	1659797504
1005	1010025	1015075125	1065	1134225	1207949625	1125	1265625	1423828125	1185	1404225	1664006625
1006	1012036	1018108216	1066	1136356	1211355496	1126	1267876	1427628376	1186	1406596	1668222856
1007	1014049	1021147343	1067	1138489	1214767763	1127	1270129	1431435383	1187	1408969	1672446203
1008	1016064	1024192512	1068	1140624	1218186432	1128	1272384	1435249152	1188	1411344	1676667662
1009	1018081	1027243729	1069	1142761	1221611509	1129	1274641	1439069689	1189	1413721	1680897429
1010	1020100	1030301000	1070	1144900	1225043000	1130	1276900	1442897000	1190	1416100	1685159200
1011	1022121	1033364331	1071	1147041	1228480911	1131	1279161	1446731091	1191	1418481	1689410871
1012	1024144	1036433728	1072	1149184	1231925248	1132	1281424	1450571968	1192	1420864	1693669888
1013	1026169	1039509197	1073	1151329	1235376017	1133	1283689	1454419637	1193	1423249	1697933657
1014	1028196	1042590744	1074	1153476	1238833224	1134	1185956	1458274104	1194	1425636	1702209384
1015	1030225	1045678375	1075	1155625	1242296875	1135	1288225	1462135375	1195	1428025	1706489875
1016	1032256	1048772096	1076	1157776	1245766976	1136	1290496	1466003456	1196	1430416	1710777536
1017	1034289	1051871913	1077	1159929	1249243533	1137	1292769	1469878353	1197	1432809	1715072373
1018	1036324	1054977832	1078	1162084	1252726552	1138	1295044	1473760072	1198	1435204	1719374192
1019	1038361	1058089851	1079	1164241	1256216039	1139	1297321	1477648619	1199	1437601	1723683599
1020	1040400	1061208000	1080	1166400	1259712000	1140	1299600	1481544000	1200	1440000	1728000000

SQUARE Root, a number considered as the root of a second power or square number: or a number, by whose multiplication into itself a square number is generated. See **ROOT**.

To extract the Square Root out of any given Number, see EXTRACTION of Roots.

SQUARE, Norma, is an instrument made of wood or metal, serving to describe and measure right angles; such is **L E M**, *Plate XIV. Geometry, fig. 10.*

It consists of two rules or branches fastened perpendicularly at one of their extremes. When the two branches are moveable on a joint, it is called a *bevel*.

To examine whether or not a square be exact, describe a semicircle, **A E F**, of any length, at pleasure; and therein, from each extreme of the diameter, **A** and **F**, draw right lines to a point taken at pleasure in the periphery, as **E**: to the sides of the angle, **A E F**, apply the square, so as its vertex may fall on **F**. If this be possible, that square is just.

SQUARE, The, an instrument used in drawing, which consists of a flat ruler *h g* (*fig. 11.*), at one end of which are fastened two transverse pieces; one of them, *a b*, fixed at right angles to it, and the other, *c d*, moveable round the centre *f*, so as to be fixed at any angle required. These transverse pieces are applied close to the side of the drawing-board, which is a smooth board made in the form of a square, or parallelogram, while the ruler lies upon it; and by sliding them along the board, lines may be drawn parallel to one another with much less trouble than by the help of a parallel ruler. By the fixed transverse, lines may be drawn parallel to one side of the board, and perpendicular to the other; and, by the moveable transverse, lines that have any degree of obliquity to the sides of the boards, may be drawn parallel to one another: and if, without moving the transverse, the ruler be removed to the other side of the board, lines may be drawn perpendicular to them. But if the obliquity be very great, it will be impossible to apply the square, so as to intersect the lines at right angles in some parts of the board. In this case recourse must be had to a parallel ruler.

SQUARE, Geometrical, a compartment frequently added on the face of the quadrant, called also line of shadows and quadrant.

SQUARE, Gunner's. See **QUADRANT**.

SQUARES, Magic. See **MAGIC Square**.

SQUARE, in Glass-Making, an instrument with which the conciator, or founder, stirs and mixes together the metal, when in fusion in the melting-pots. When this instrument is grown red-hot, it is always to be quenched in a pail of water, otherwise the metal will stick to it.

SQUARE, in the Manège, is used for working in a square. The pite or tread of a volt, instead of being always circular, and traced upon a circumference round a centre, ought to be imagined as if it formed four straight equal lines laid in a square, and equally removed from the centre or the pillar, which represents it in the middle of the manege-ground; so that, to work in a square, is to ride along each of these four lines, turning the hand at every corner, and so passing from one line to another.

SQUARE, The, in the *Military Art*, a particular form into which troops are thrown on critical occasions; particularly to resist the charge of cavalry.

SQUARE Battalion, Hollow, and Solid. See the several articles.

SQUARE Cap. See **CAP**.

SQUARE Character. See **HEBREW**.

SQUARE Foot, Nails, Niche, Pedestal, Pillar, Roof, and Winding-stairs. See the substantives.

SQUARE, in Sea Language, a term peculiarly appropriated to the yards and their sails, implying that they hang at right angles with the mast or keel, or that they are of greater extent than usual.

Thus, when the yards are so balanced by their lifts, as to hang at right angles with the mast, they are said to be square by *the lifts*; when they hang perpendicular to the ship's length, they are called square by *the braces*; but when they lie in a direction perpendicular to the plane of the keel, they are square by *the lifts and braces*; or, in other words, they hang directly across the ship, and parallel to the horizon.

The yards are said to be very square when they are of extraordinary length; and the same epithet is then applied to their sails, which by consequence acquire an additional breadth.

SQUARE of an Anchor, denotes the upper part of the shank. See **ANCHOR**.

SQUARE-Body, in *Ship-Building*, all the midship part of the ship, or that between the cant-bodies, whose timbers stand at right angles, or square with the keel.

SQUARE-Maker, a shipwright, who cuts the butts of the planks when required to receive the oakum, and prepares the work ready for the caulkers.

SQUARE-Ribbands, the same as horizontal ribbands. See **RIBBANDS**.

SQUARE-Rigged, is an epithet applied to a ship which has long yards at right angles with the length of the deck, and low masts; and hence it is used in contradistinction to all vessels whose sails are extended by stays or lateen-yards, or by booms and gaffs; the usual situation of which is nearly in the plane of the keel.

Hence, square-sail is a sail extended to a yard, which hangs parallel to the horizon, as distinguished from the other sails, which are extended by booms and stays, placed obliquely. This sail is only used in fair winds, or to scud under in a tempest. In the former case it is furnished with a large additional part, called the bonnet, which is then attached to its bottom, and removed when it is necessary to scud. Falconer.

SQUARE-Sterned, a term applied to ships having broad sterns, and the butts of the planks of the bottom ending on the wing-transom. All British ships are now built upon this principle, whilst many of other nations are still constructed by the ancient methods; hence we so frequently hear the phrase of "square-sterned and British-built," as our practice in this respect justly claims the superiority over that of all other nations.

SQUARE-Timbers, the timbers which stand at right angles, or square with the keel. See **SQUARE-Body**.

SQUARE-Tuck, a name given to the after-part of a vessel's bottom, when terminated in the same direction up and down as the wing-transom; and the planks of the bottom end in a rabbet at the fore-side of the fashion-piece.

SQUARE Handkerchief, in *Geography*, a cluster of islets and rocks in the Atlantic, formerly called "Bazos de Babuca;" extending above 100 miles in circumference. N. lat. 21°. W. long. 69°.

SQUARE Island, a small island in the N. part of lake Superior. N. lat. 48° 40'. W. long. 87° 22'.—Also, an island near the E. coast of Labrador. N. lat. 52° 54'. W. long. 55° 34'.

SQUARING, in Mathematics. See **QUADRATURE**.

SQUARING the Circle, is the making a square whose area shall be equal to the area of a given circle:

The best mathematicians have found it impossible to solve this

this problem so as to be precisely exact; but they can easily come so near it, as not to err so much in the area as a grain of sand would cover in a circle, whose diameter is equal to the diameter of Saturn's orbit. The following proportions are near enough to the truth for any real use that can arise from this problem.

As 100000000 is to the diameter of the given circle, so is 88622692 to the side of the square required. Therefore,

If the Diameter of the Circle be	The Side of the Square will be
100000000	88622692.
10000000	8862269.2
1000000	886226.92
100000	88622.692
10000	8862.2692
1000	886.22692
100	88.622692
10	8.8622692
1	0.88622692

And, as 100000000 is to the side of a given square, so is 112837917 to the diameter of a circle very nearly equal to the square. Therefore,

If the Side of the Square be	The Diameter of the Circle will be
100000000	112837917.
10000000	11283791.7
1000000	1128379.17
100000	112837.917
10000	11283.7917
1000	1128.37917
100	112.837917
10	11.2837917
1	1.12837917

See CIRCLE, DIAMETER, and QUADRATURE.

SQUARTIA, in *Ichthyology*, a species of fish found in the East Indies, the skin of which makes the shagreen.

SQUASH GOURD, in *Gardening*, the common name of a particular sort of gourd-plant, with erect stems or stalks. See CUCURBITA.

SQUASH Pear-tree. See PEAR-tree.

SQUATAROLA, in *Ornithology*, a name given by the Venetians to the grey plover, or *pluvialis cinerea*.

SQUATINA, in *Ichthyology*, the monk-fish, a species of the squalus, called, in Italian, the *pesce angelo*, and thence in English the angel-fish and monk-fish. See SQUALUS.

SQUATINATORIA, a name by which some authors have called the *rhinobatos*, a sea-fish of a sort of middle nature between the monk-fish, or angel-fish, and the ray.

SQUATT, in *Mineralogy*, a term given by the English miners to a peculiar sort of bed of ore, less valuable than a load or vein, because of its reaching but a little way.

Though the ore of the squatts is generally very rich and good, not inferior in quality to the best vein-ore, the miners are often disappointed, on finding these squatts instead of the right veins, after a long search. In the tin countries, the way of searching for mines is by looking after the SHOAD-STONES, which see.

These upper parts of the veins have been washed off, and carried down the sides of the hills, in which the mines usually lie, into the flat country; but they always lie in a regular and continued train, from the orifice of the mine to the farthest part of the train; so that when but one stone of this kind is found, the miners are certain of coming to the bed of metal, on tracing it up to its head by the train. This is a laborious and expensive work, because the stones never

lie on the surface, but at the different depths of one to ten feet, or any depth between these. The squatts have their trains of shoad-stones as well as the regular veins, and when these are traced to the orifice, there is the appearance of a rich load, which the proprietor is not thoroughly undeceived in till the diggers come to the end of it.

The squatt is a bed of ore from three to ten fathoms long, and usually is about half as broad as it is long; few are larger than this standard, but many much less. This is always flat, and thence has its name; the round collections of ore of the same kind being called *bonnies*. The squatt communicates with no other load or vein, but is entire of itself, and its extremities terminate at once, without running into several little strings, in the manner of those of the right veins. It does not lie within walls, as the loads or veins always do, though it is always deposited in the shelf, or fast ground; that is, in strata that have not been moved. Phil. Trans. N^o 69.

SQUATUS, in *Ichthyology*, a name used by Pliny, and other of the old Roman authors, to express the fish called by the old Greek writers *rhine*, and by the moderns *squatina*. See SQUALUS.

SQUIB and Mince-meat Manures, in *Agriculture*, are terms which are applied to those sorts which are collected in large towns, as the metropolis, and others. The former chiefly consists of the more small mixed powdery kinds, but the latter principally of the more reduced animal matters. They would both seem to be superior to foot or malt-dust in the trial of a writer in the Agricultural Report of the County of Middlesex. See SOOT and MANURE.

SQUIBS. See FIRE-Works.

SQUILACHI, in *Zoology*, the name by which the modern Greeks call the jackall, or *lupus aureus* of authors.

SQUILL. See SQUILLA.

SQUILL, *Official*, or *Sea-onion*, *Scilla Maritima*, in the *Materia Medica*. The roots, or rather the bulbs, of this species are the parts that are used in medicine. Of these bulbs there are two sorts, the red and white, which are supposed to be accidental varieties; but for medicinal use the red is generally preferred, as it has been supposed to be more efficacious than the other. They grow naturally on sea-shores, or in ditches where the salt-water flows in with the tide, in most of the warm parts of Europe; particularly on sandy shores in Spain and in the Levant, from whence we are annually supplied with them. They should be chosen large, plump, fresh, and full of a clammy juice. They are preserved fresh in sand; but as they are apt to spoil, it is best to keep them in the dried state. However, the fresh bulb loses in drying about four-fifths of its weight, without any considerable loss of its taste or virtue: hence four grains, which are the mean dose of the dry bulb in powder, are equivalent to near a scruple of the fresh squill. Nevertheless, its acrimony, on which its virtue depends, is partially dissipated by drying and long keeping; and completely destroyed by heat. The most convenient way of drying it is, after peeling off the outer skin, to cut the bulbs transversely into thin slices, and expose them to a gentle warmth. The ancients, in order to abate the acrimony of the squill for certain purposes, after separating the skin and fibres, enclosed it in a paste made of flour and water, and then baked it in an oven, till the paste became dry, and the squill thoroughly soft and tender. The squill, so prepared, was beaten with two-thirds its weight of flour, the mixture formed into troches, and dried with a gentle heat. These troches were supposed to be alexipharmic, and on this account were used as an ingredient in theriaca, with which view they are still retained. Water, wine, proof-spirit, and rectified spirit, extract the virtues

both of the fresh and dry bulb. Nothing rises in distillation with any of these menstrua, the entire bitterness and pungency of the squill remaining concentrated in the inspissated extracts: the spirituous extract is smaller in quantity than the watery, and its taste is proportionally stronger, almost fiery. Alkalies considerably abate both the bitterness and acrimony of the squill: vegetable acids make little alteration in either of these respects. These acids extract its virtue equally with watery or spirituous menstrua; and, as an expectorant in disorders of the breast, excellently coincide with it.

The expressed juice, when diluted with water, filtered, and boiled, yields white flakes of albumen. Nitrate of mercury and superacetate of lead separate from it white curdy precipitates. Infusion of galls forms in it pale brownish flakes; sulphate of iron throws down a copious pale green precipitate: lime evolves ammonia. When the insoluble part of dried squill is digested in muriatic acid, filtered, and ammonia added in excess, a copious precipitate is thrown down, which is oxalate of lime. Ether digested on dried squill acquires a pale green hue, and when evaporated on the surface of water, a thin pellicle of very bitter resin is deposited; while the water acquires an intensely bitter taste, and yields copious precipitates with solutions of acetate of lead and nitrate of silver. From these imperfect experiments, squills appear to contain extractive, albumen, a small portion of resin, mucus, carbonate of ammonia, the bitter principle, starch, and oxalate of lime.

The root of the squill has been known in medicine in the early ages of Greece; so that the introduction of its medical use has been referred by some to Epimenides, and by others to Pythagoras. It is noticed by Dioscorides, Hippocrates, Galen, Aëtius, Celsus, Pliny, Cælius Aurelianus, and the Arabian physicians. Its medical character has been retained ever since to such a degree, that it is still deservedly held in high estimation, and frequently used. It seems, however, to manifest a poisonous quality to several animals, as many medical writers have testified. If administered in large and repeated doses, it not only excites nausea, tormina, and violent vomitings, but it has been known to produce strangury, bloody urine, hypercatharsis, cardialgia, hæmorrhoids, convulsions, with fatal inflammation and gangrene of the stomach and bowels. Nevertheless, under proper management, and in certain cases and constitutions, it merits recommendation as a medicine of great practical utility, and real importance in the cure of many obstinate diseases. In small doses it is expectorant and diuretic; but in large doses, emetic and purgative: but when these latter effects take place, the medicine is prevented from reaching the blood-vessels and kidneys, and the patient derives no benefit from its diuretic efficacy. In such cases it should be given in smaller doses, at more distant intervals, or an opiate should be joined to it, which, according to Dr. Cullen, will answer the same purpose. By repeated use the dose may be increased, and the intervals of administering it diminished; and accordingly, when the doses are tolerably large, the opiate may be most conveniently employed to direct the operation of the squill more certainly to the kidneys. In cases of dropsy, he says, when there is an effusion of water into the cavities, and therefore less water passes to the kidneys, neutral salt, accompanying the squill, may be of use in determining it more certainly to the kidneys; and when it is perceived to take this course, he is persuaded that it will be always useful, and generally safe, during the exhibition of the squills, to increase the usual quantity of drink. The diuretic effects of squills have been supposed to be promoted by the addition

of some mercurial; and Dr. Cullen is of opinion, that the less purgative preparations of mercury are best adapted to this purpose; and accordingly he recommends a solution of corrosive sublimate or oxymuriate of mercury, as the most proper, because it is the most diuretic.

Wagner recommends the powder of squills, given with nitre, in hydropical swellings, and in a nephritis, and mentions several examples of cures which he performed, by giving patients from four to ten grains, with a double quantity of nitre.

When squill has been employed as a diuretic, it has been usual to give it in powder, because in this state it is less apt to produce nausea; and it has been customary to add neutral salts, as nitre, or crystals of tartar, especially if the patient complained of much thirst; others recommend calomel: and with a view to render the squills less offensive to the stomach, it has been usual to conjoin an aromatic.

In asthmatic affections, or dyspnoea, occasioned by the lodgment of tenacious phlegm oppressing the lungs, or when the primæ viæ abound with mucous matter, it has been the expectorant usually employed; and held in general estimation. As an expectorant, the squill may be supposed not only to attenuate the mucus, and thus facilitate its ejection, but by stimulating the excretory organ and mucous follicles, to excite a more copious excretion of it from the lungs, and thereby lessen the congestion, upon which the difficulty of respiration very generally depends. Hence, in all pulmonic affections, excepting only those of actual or violent inflammation, ulcer, and spasm, the squill has been found to be a very useful medicine.

The root of squill is to the taste very nauseous, intensely bitter and acrimonious; but without any perceptible smell: much handled, it excoriates the skin. It is rendered more useful as an expectorant, when combined with nitrate of potash, tartarized antimony, or ipecacuanha; and in asthma and dyspnoea without fever, squill combined with ammoniacum is perhaps the best remedy we can employ.

Dr. Hefs says, he has cured the asthma with the powder of squills. The efficacy of this powder, from four to twelve grains, in curing the asthma, is attested by several. Med. Ess. Edinb. Com. Norimb. 1737, and 1739.

As an emetic, squill is very uncertain in its effect, producing in some persons the most cruel vomiting, and in others exciting no nausea in the largest doses: nevertheless, when it readily and moderately induces vomiting, it proves more useful in hooping-cough and croup, than any other emetic.

For producing expectorant and diuretic effects most effectually, squill must be given in substance; but to excite vomiting, its infusion in vinegar, or the oxymel, is more usually employed. Of the dried squill, gr. j, in the form of a pill, may be given at first for a dose, morning and evening, or every six hours; and the quantity gradually increased to grs. v or grs. vj, or till some degree of nausea is induced, and its expectorant or diuretic operation obtained.

The official preparations of squills are the following: viz. *acetum scillæ*, *oxymel scillæ*, *pilule scillæ comp.*, *pulvis scillæ*, *syrupus scillæ maritimæ*, and *tinctura scillæ*. The "*acetum scillæ*," or vinegar of squill, of the Lond. Ph. is prepared by macerating 1lb. of fresh squill root (bulb) dried in six pints of acetic acid, in a covered vessel, for 24 hours; then expressing the liquor, and setting it aside, that the feculencies may subside; and lastly, adding half a pint of proof-spirit to the clear liquor.

The "*acetum scillæ maritimæ*," or vinegar of squill, of the Edinb. Ph. is prepared by macerating 2 oz. of the squill root (bulb) dried, with 2½ lbs. of distilled vinegar, for seven

seven days; then expressing the liquor, and adding to it 3 oz. of alcohol; and when the feculencies have subsided, pouring off the clear fluids.

The "acetum scillæ," or vinegar of squill, of the Dub. Ph. is obtained by digesting half a pound of fresh squill root (bulb) dried, with three pints of wine vinegar, for four days in a glass vessel, with frequent agitation; then expressing the vinegar; and, after the feculencies have subsided, adding to it four fluid-ounces of rectified spirit.

This has been long used as an expectorant and diuretic in chronic catarrh, humoral asthma, and dropsies. The dose is from fʒs to fʒij, given in cinnamon or mint-water. In large doses it produces vomiting, and is occasionally used as an emetic in the above-mentioned diseases, when the stomach is loaded. For the "oxymel of squill," see OXYMEL *Scilla*. For the "pills of squill," see PILLS.

The "pulvis scillæ," or powder of squill, of the Dub. Ph. is prepared by freeing squill roots (bulbs) from their membranous integuments, and cutting them in transverse slices, then drying them upon a sieve with a low degree of heat; and afterwards reducing them to powder, which must be preserved in well-stopped glass phials.

The "syrupus scillæ maritimæ," or syrup of squill, of the Edinb. Ph. is formed of 2 lbs. of vinegar of squill and 3½ lbs. of refined sugar powdered; dissolving the sugar by a gentle heat, so as to make a syrup. This syrup has the same properties, and is used for the same purposes, as the oxymel of squill. The dose is from fʒj to fʒij, given in any aromatic distilled water.

The "tincture of squills" of the Lond. and Dub. Ph. is prepared by macerating 4 oz. of recent squill root (bulb) dried, with two pints of proof-spirit, for 14 days, and filtering. The Dub. Ph. directs digestion for seven days, setting it aside until the dregs are subsided, and pouring off the clear liquor. The dose is from ℥x to ℥xxx, given in almond mixture, ammoniac mixture, or mucilage. Lewis. Woodville. Thomson.

SQUILLS, *Wine of*, is an infusion of the roots of squills in white wine for forty days, after which the squills are taken out, and the liquor preserved for use. It is a gentle emetic, and is good against defluxions of rheum.

SQUILL, *White, Lesser*, in *Botany*, a species of *pancratium*; which see.

SQUILL, *Squilla*, in *Natural History*, a large class of animals, comprehending the shrimp, or *cancer crangon*; the crawfish, or *cancer fluviatilis*, or *cancer asellus* of Linnæus; the crab, or *cancer*; lobster, or *cancer gammarus*; prawn, or *cancer squilla*. The *squilla* is also a genus described under CANCER: all which, according to Dr. Hill, make only one genus of insects of the podaria kind. They properly belong to the genus of CANCER, under which they are described.

SQUILLA, in *Botany and Gardening*. See SCILLA.

SQUILLA *Aque Dulcis*, or *fresh-water shrimp*. Few persons are aware of the damage done by the fresh-water shrimp among the small fry of fish. This insect is commonly very plentiful in standing waters, and particularly in breeding-ponds, where they always have their prey in plenty before them; and often suffer none, or scarcely any of the numerous young fry hatched from the spawn of carp and tench, to live to grow up. They may be observed following the shoals of the young fry, and seizing multitudes one after another; and at other times lurking among the weeds to seize such as straggle by themselves. If one of these insects be put into a basin of water with a dozen or two of these young fish, though as big as itself, it will very

soon destroy them all. They kill numbers that they cannot eat, but leave them to rot.

SQUILLACE, in *Geography*, a sea-port town of Naples, in Calabria Ultra, built on the verge of a rocky mountain, sloping to the east, about three miles from the sea; and giving name to a gulf of the Mediterranean. It is the see of a bishop, suffragan of Reggio, and contains eleven parishes and six convents. Virgil, for reasons unknown, gave this city the epithet of "Navisragum," breaker of ships, as there are no hidden or apparent dangers attending the approach of vessels; and we cannot suppose, that this correct poet should be so negligent, as to confound the capacious bay of "Scyllacæum," as this is called, with the narrow pass of Scylla in the Faro of Messina. In forming the body of Grecian commonwealths on the Italian shores, Athens furnished emigrants for Scyllacæum; but this settlement never made any figure in the confederacy. Rome sent a colony hither. In the year 982 the emperor Otho II. was defeated under its walls by the forces of the Greeks. Montfort obtained this lordship in fee from Charles of Anjou; but in the next reign it was given to the Marsans. When this powerful house was overturned by the Aragonese, the fief was bestowed upon that of Borgia, and was afterwards vested in the marquis Gregori, who, from being a commissioner of the victualling office at Messina, rose to be prime minister of Naples, and afterwards of Spain. Squillace prides itself on having given birth to Cassiodorus, a statesman of great abilities, and, considering the times he lived in, a very respectable author, beloved and honoured by Theodoric, and other Gothic monarchs. To this town, which was the place of his nativity, he retreated in his old age; and he amply describes it; 33 miles S.S.E. of Cosenza. N. lat. 38° 48'. E. long. 16° 44'.

SQUINANCY, or ESQUINANCY. See QUINZY.

SQUINDER, in *Rural Economy*, a word signifying to burn inwardly, or in a smothering manner, as charcoal and some other substances are burnt.

SQUINTING, in *Medicine*, *Strabismus*, an irregular position and motion of the eyes, in which their axes do not converge to the object looked at.

It is certain, that when the axes of the eyes of persons who do not squint are directed in different lines, objects are seen double; squinting persons, however, do not see objects double. Yet it is well known that the principal reason which has been adduced for the singular phenomenon, that the images impressed upon the two eyes excite only one image in the mind, is, that the two images fall upon corresponding points of the eyes. The probability, therefore, is, that, in a squinting person, both eyes do not see the object looked at. In many cases, indeed, "this is pretty evident to a by-stander," as sir E. Home has remarked, "who is able to determine, that the direction of one of the eyes differs so much from that of the other, that it is impossible for the rays of light from any object to fall on the retinas of both; and therefore that one eye does not see the object. The same thing may be proved in another way. For since a small deviation in the direction of either eye from the axis of vision produces double vision, any greater deviation must have the same effect, only increasing the distance between the two images, till it becomes so great, that one eye only is directed to the object. In squinting there is evidently a greater deviation from the axis of vision than in double vision, and the object does not appear double: it is therefore not seen by both eyes." (See Phil. Trans. vol. lxxxvii. for the year 1797, p. 13.) It is manifest, indeed, that the perception is not distinct; but this, as Dr. Porterfield remarked, may be

the result of habit and experience, by which the mind learns to correct the impressions of the senses. (See Edin. Medical Essays, vol. iii. § 12.) In order to ascertain the nature of this affection, it will be necessary to investigate its varieties and causes.

Dr. Cullen was of opinion, that all the varieties of strabismus, described by Sauvages and others, might be included under three species, which he designated by the appellations *habitualis*, *commodus*, and *necessarius*. The *first* of these may arise from the habit of using only one eye in viewing objects, while there is no defect either in the organ itself, or in the muscles which move it. In this way children may learn to squint from having objects, which attract their attention, placed obliquely near the cradle; in which case it will be more easy to view them with the opposite eye alone, than to direct both towards the same point, and they will thus acquire the habit of neglecting the use and motions of the other eye. In a later period of life, the power of squinting voluntarily appears to be acquired by some by this practice of using one eye. Thus persons who look much through telescopes, and of course employ one eye almost exclusively, may acquire the power of moving the one more than the other, or lose a part of their command over the muscles of the neglected eye.

Dr. Darwin mentions a singular case of squinting, in which the patient was equally expert in the use of either eye, but viewed every object presented to him with only one eye at a time, and always with the eye on the side opposite the object. Thus, if the object was presented on his right side, he viewed it with his left eye; and when it was presented on his left side, he viewed it with his right eye. At the same time, Dr. Darwin found that he turned the pupil of that eye which was on the same side with the object in such a direction, that the image of the object might fall on that part of the bottom of the eye where the optic nerve enters it, and where it would of course excite no impression; and this insensible portion of the retina, Dr. Darwin ascertained by some ingenious experiments to be four times greater in this patient than in ordinary persons. When an object was held directly before this patient, he turned his head a little to one side, and observed it with but one eye, *viz.* with that most distant from the object, turning away the other in the manner just mentioned; and when he became tired with examining it with that eye, he turned his head the contrary way, and observed it with the other eye alone, with equal facility; but never turned the axes of both eyes on it at the same time. Phil. Transf. vol. lxxviii. p. 86.

The *second* species of squinting, however, which Dr. Cullen styles *commodus*, and which is the effect of some imperfection in one of the eyes, is the most common form of the disease. It has generally been admitted, or ascertained by experiment, in those who have a confirmed squint of this nature, that one of the eyes is too imperfect to see distinctly. Of this, however, the patient is not always conscious, as was evinced in a young lady, whose case is related by sir Everard Home. Neither herself nor her friends believed that any defect of the eye existed; and upon being asked if she saw objects distinctly with both eyes, she said certainly, but that one was stronger than the other. To ascertain the truth of this, he covered the strong eye, and gave her a book to read, when, to her astonishment, she found she could not distinguish a letter, or any other near object. More distant objects she could see, but not distinctly: when she looked at a bunch of small keys in the door of a book-case, about twelve feet from her, she could see the bunch of keys, but could not tell how many there were.

The obscurity of vision in one eye, then, is the cause of this common species of squinting, and may occasion this irregularity in the following way. The obscure image, being so imperfectly formed in the weak eye, as to excite little attention in the mind, the use of the eye, and its uniform direction to the same object with the other, may have been neglected from the beginning; for as distinct vision was obtained at once by the perfect eye, the end was answered, and therefore there was no necessity for any exertion to employ the other. Or on the other hand, in the effort to get rid of the confused image, the muscles may have acquired an irregular and unnatural action. It is remarked by sir E. Home, that the direction, which the eye takes under either of these circumstances, is inwards, towards the nose; because the *adductor* muscle is stronger, shorter, and its course more in a straight line, than any of the other muscles of the eye. Phil. Transf.

In the *third* species, or *strabismus necessarius* of Cullen, the squinting is the result of some peculiarity or change in the form or situation of the eye or its parts; whence a perfect and distinct image of any object can only be obtained by an oblique direction of the axis of the eye. Dr. Porterfield has pointed out two varieties of this kind, arising, the one from an oblique position of the crystalline lens within the eye, by which the image of an external object is refracted out of the line of the axis of the eye;—and the other, from an oblique position and greater protuberancy of the cornea, which produces a similar effect. (See Edin. Medical Essays, vol. iii. art. 12.) These appear to be synonymous with the *strabismus à crystallino*, and *S. myopum* of Sauvages (Nosol. Meth. class. iv. gen. i. spec. 12 & 9.) Other partial diseases of the eye may contribute to render oblique vision the most convenient; such as *leucoma*, *hypopion*, *pterygium*, &c. enumerated by Sauvages as constituting his eleventh species, *S. caligantium*.

Cure of Squinting.—The two first species of squinting, arising from the habit of using one eye only, or from the weakness or imperfection of the other, may be sometimes cured. The third, which arises from some malformation of the eye or its parts, is scarcely remediable.

The principle of cure in the two first species is nearly the same; namely, the constant exercise of the neglected eye, whether naturally weak or not. This may be effected by covering the strong eye, or that which is always employed, and confining the person to the use of the neglected or weak eye. For in this way, the muscles of the latter, from constant action, will become perfect in the habit of directing the eye upon the object, gain strength in that action, and acquire a power of adjusting the eye. When this is established in a sufficient degree, the other eye may be set at liberty. The time that will be necessary for the cure, will depend upon the inveteracy of the habit, the length of time that the muscles have been left to themselves, and the degree of weakness of the sight: for it is with difficulty that muscles acquire an increased degree of action after having been long habituated to a more limited contraction. Dr. Darwin observes, that if the squinting has not been confirmed by long habit, and one eye be not much worse than the other, a piece of gauze stretched on a circle of whalebone, to cover the best eye in such a manner as to reduce the distinctness of vision of this eye to a similar degree of imperfection with the other, should be worn some hours every day.

For the cure of the curious case related by the same ingenious physician, in which there was no defect in either eye, but merely a depraved habit of using both eyes separately, Dr. Darwin says, “a gnomon of thin brads was made to

SQUINTING.

stand over his nose, with a half circle of the same metal to go round his temples; these were covered with black silk, and by means of a buckle behind his head, and a cross-piece over the crown of his head, this gnomon was managed so as to be worn without any inconvenience, and projected before his nose about two inches and a half. By the use of this gnomon he soon found it less inconvenient to view all objects with the eye next to them, instead of the eye opposite to them.

“After this habit was weakened by a week’s use of the gnomon, two bits of wood, about the size of a goose-quill, were blackened all but a quarter of an inch at their summits: these were presented for him to look at, one being held on one side the extremity of his black gnomon, and the other on the other side of it. As he viewed these, they were gradually brought forwards beyond the gnomon, and then one was concealed behind the other. By these means, in another week, he could bend both his eyes on the same object for half a minute together.

“By the practice of this exercise before a glass, almost every hour in the day, he became in another week able to read for a minute together with his eyes both directed on the same objects; and I have no doubt, if he has patience enough to persevere in these efforts, but he will in the course of some months overcome this unsightly habit.” Phil. Trans. vol. lxxviii. p. 89.

Philosophers, as well as physicians, have adopted various hypotheses, in order to account for this defect in vision. It has been generally supposed to proceed, according to the preceding statement, from the want of a due correspondence in the muscles of the eyes, which not acting in a proper concert with one another, are not able to point both eyes at one object. M. de la Hire apprehended, that this disorder proceeded from a defect in the eye itself having the most sensible part of the retina not placed in the axis of the eye, but at some distance from it on one side or the other; and that, therefore, not the axis, but this more sensible part of the retina is turned towards the object on which the axis of the other eye is fixed, so that both axes are not directed to the same point.

He supposed squinting, also, sometimes to be owing to the oblique situation of the crystalline humour in one of the eyes. These hypotheses are examined and refuted by Dr. Jurin, who, in order to account for this defect, considers the disposition and situation of the eyes in a sound state. When we look directly forwards at a distant object, the pupil of each eye lies in the middle of the aperture formed by the eye-lids; so that the distance between the two pupils consists of the breadth of the nose and half the breadth of the aperture of each eye; and this distance between them is always preserved, however obliquely we turn our eyes. In looking at near objects, the distance between the pupils is somewhat less, but still it is always the same in all oblique directions of the eyes, as well as when we look straight forwards; by which means the axes of both eyes are directed forwards to the same point, in both these cases of looking at distant and near objects. But in those who squint, when the pupil of the undistorted eye is seated in the middle of the aperture, as in looking directly forwards, the pupil of the other eye is drawn close to the nose, and consequently, the distance between the two pupils is considerably less than in other persons; and this less distance continues the same in all oblique directions for the eyes; so that two axes are never pointed at the same object, though the muscles do so far act in concert with each other, as to move both eyes the same way at the same instant of time.

This vicious habit, Dr. Jurin observes, may easily be

contracted by a child, if he is often laid into his cradle in such a position as to be able to see either the light, or any other remarkable object, with one eye only: and when by this means he is brought to squint, and the habit is confirmed, he apprehends it will be in vain to attempt a cure by his wearing tubes, or shells, with small holes to look through; for, notwithstanding every help of this kind, he will continue to see through them distinctly with one eye only, and will still distort the other. The true method of cure he takes to be the following: when the child is arrived at such an age as to be capable of observing directions, place him, says he, directly before you, and let him close the undistorted eye, and look at you with the other. When you find the axis of this eye fixed directly upon you, bid him endeavour to keep it in that situation, and open his other eye. You will now see the distorted eye turn away from you towards his nose, and the axis of the other eye will be pointed towards you. But with patience and repeated trials, he will, by degrees, be able to keep his distorted eye fixed upon you, at least for some little time, after the other is opened; and when you have brought him to keep the axes of both eyes fixed upon you, as you stand directly before him, it will be time to change his posture, and to set him first a little on one side of you, and then to the other, and so to practise the same thing; and when in all these situations he can perfectly and readily turn the axes of both eyes towards you, the cure is effected. An adult person, he says, may practise all this by a glass, without a director, though not so easily as with one; but the older he is, the more patience will be necessary. Smith’s Optics, Rem. p. 30.

M. Buffon infers, from a great number of observations, that the true and original cause of squinting is an inequality in the goodness, or in the limits of distinct vision in the two eyes. When one of the eyes, he says, is much weaker than the other, we do not direct it towards the object, but make use of the stronger eye only: when the eyes are equally good, we see more distinctly with both eyes than with one, by about a thirteenth part; but when they are unequal in goodness, objects appear less distinct with both eyes than with one. It is no wonder, therefore, that persons, subject to this inequality, chuse to make use of one eye, and turn the other aside. This inequality in the goodness of the eyes is the general cause of squinting, according to M. Buffon; and others, with respect to this, are accidental. All the persons whom he examined, if they squinted at all, did so from this cause; and this effect is so necessary, that, he says, it is not possible to cure a person of squinting, whose eyes differ much in point of goodness, except, perhaps, by first bringing them nearer to an equality by means of glasses. To the same purpose Dr. Reid observes, that, having examined above twenty persons who squinted, he found in all of them a defect in the sight of one eye. And this writer is of opinion, that the centres of the two eyes of squinting persons correspond with them as with others, so that if they could be brought to the habit of directing their eyes aright to an object, they would not only remove a deformity, but likewise improve their sight.

In examining the limits of distinct vision in several children who did not squint, M. Buffon found, (contrary to Dr. Jurin’s observation,) that they did not see by any means either so far off, or so near as adult persons; so that, as we advance in age, the limits of distinct vision are extended both ways; and this, he says, is one reason why children squint more than adult persons.

When the eyes of those persons who squint do not differ much in point of goodness, M. Buffon thought that the most

most simple, the most natural, and the most effectual method of curing it, would be to cover the good eye for some time; for the distorted eye would thus be obliged to act and turn itself directly towards objects, and, by degrees, this would become natural to it.

The reason why those persons who squint generally turn the weak eye towards the nose, he says, is, that in that situation, the direction of its axis is as distant as possible from that of the good eye: and besides, in this place, the nose conceals many objects from its view, so that this situation is the least disadvantageous to it of any other.

In some cases, M. Buffon observes, that the eyes have what is commonly called a *cast* only, in consequence of the optic angle being too great or too small, when they are of equal goodness. This, he says, is generally the result of habit, acquired very early, in consequence of the mismanagement of children, and that it is often easily cured. If the eye that squints be turned towards the temples, he says, he has generally found that there is no great inequality in the goodness of the two; and that, in this case, the cause being only a vicious habit, the cure has been completed by covering the good eye for a fortnight only. In order to judge with any certainty of the inequality of goodness in the two eyes, and the possibility of the cure of squinting, it is necessary, he says, to cover the good eye for some time, in order to exercise the bad eye, and give it an opportunity of gaining strength, after which it will be more easy to judge whether the cure be possible or not. Acad. Par. 1743, p. 329. 342. Reid's Inq. into the Human Mind, p. 253—257. See *Physiology of the Eye*.

SQUINZANO, in *Geography*, a town of Naples, in the province of Otranto; 6 miles N.W. of Lecce.

SQUIRE, SAMUEL, in *Biography*, a learned English prelate, was born at Warmiafter in 1714. He was educated at St. John's college, Cambridge, of which he became a fellow. After various instances of preferment, he obtained the vicarage of Greenwich, and was appointed clerk of the closet to the prince of Wales, his present majesty. In 1760 he was promoted to the deanery of Bristol; and in the following year he was advanced to the see of St. David's. He died in 1766, leaving behind him several works of reputation, besides a number of single sermons. His principal pieces are as follow. In his profession as a divine, he wrote "The ancient History of the Hebrews vindicated;" "Indifference for Religion inexcusable;" and "The Principles of Religion made easy to young Persons." In classical literature, he published "Two Essays: (1) A Defence of the ancient Greek Chronology; (2) An Inquiry into the Origin of the Greek Language;" and an edition of "Plutarch de Iside et Osiride," Gr. and Engl., with commentaries and various readings. His works, as a political writer, are, "An Inquiry into the Nature of the English Constitution, or an historical Essay on the Anglo-Saxon Government both in Germany and England;" "An Essay on the Balance of Civil Power in England;" and "Remarks upon Mr. Carte's Specimen of the General History of England." He left in MS. a Saxon grammar, compiled by himself. Dr. Squire was a fellow of the Royal and Antiquarian Societies. Gen. Biog.

SQUIRREL, SCIURUS, formed of *σκια*, *shade*, and *ερα*, *tail*, because the tail serves this animal for an umbrella, is a genus of animals described under **SCIURUS**.

There is great diversion in hunting the common English squirrel, and its flesh is very delicate and well tasted. The only season for hunting it is in autumn, and the beginning of winter, at which time the creature is fat; and the leaves being off the trees, it may be seen as it leaps from bough

to bough, which, when pursued, it does with surprising agility.

In the summer they build their nests, which the sportsmen call *drays*, very artificially in the tops of trees, with sticks, moss, and such other things as the woods afford: to their nest they have two holes, and they stop up that on the side the wind blows, as Pliny has remarked; they fill this lodging, during the season, with nuts and other fruits, which are to serve them in the severe weather, when the trees afford nothing. They sleep in the midst of this provision a great part of the winter, and that so soundly, that they will not be waked by ever so loud a noise made just under their drays; though at other times they fly out immediately on hearing any noise, even at a considerable distance.

In the spring the female is seen pursued from tree to tree by the males, feigning an escape from their embraces.

The tail of the squirrel, which is as large as the body, though composed almost entirely of hair, serves the creature in some sort instead of wings; for by means of it the body is kept suspended in the air, without any visible sinking, while the creature throws itself from the boughs of one tree to those of another of equal height. But the more general leaps the squirrel takes, are from the outermost branches of a high tree to another somewhat lower at a distance: it is wonderful to see how far it will be carried in these leaps; and if it misses the tree it aims at, and by that means falls from the top of ever so high a tree to the ground, the tail supports it so well that it comes softly down, and receives no harm. The hunting of the squirrel is most agreeably performed in woods of a young growth, the trees of which may be shaken by the hands; and it is necessary to take out some means of dislodging them from the clefts of trees, in which they will take refuge, and from which they will never be removed by mere noise.

Many people usually go together on this expedition, and sometimes they carry bows and arrows for the dislodging of the prey from these places; sometimes bludgeons, or short or thick staves, loaded at one end with lead, to prevent their lodging in the tree when they are thrown up. The squirrel, which in its fright has taken refuge in any part of a tree, and is not to be dislodged either by hallooing or shaking the tree, will always quit the place as soon as an arrow or bludgeon has been well aimed at it, and will give a farther chase.

The squirrel is always fond of a large oak in time of danger, and runs to the nearest it can find, as soon as it sees itself pursued: in some part of the upper boughs of this tree it sits secure from the men and dogs, and as it is too troublesome to the sportsmen to climb every tree, the only method is to shoot arrows, and throw bludgeons at it; it is very seldom hurt by these, unless hit just upon the head, for its back-bone is so strong, that it will bear nearly as hard a blow as a dog, without danger of hurt. So long as the strength and spirits of the creature last, it always keeps in the tops of the highest trees; but when it grows weary, it comes down, and takes shelter in the hedges. The squirrel then soon becomes a prey to the dogs, or is very often killed upon the ground, in attempting to gain the hedge in places where there is no continued chain of trees by which it can come at it.

It is observed, that the gullet of this animal is very narrow, to prevent it from disgorging its food in descending of trees, or in its leaps downwards.

SQUIRTING or **SPURTING Cucumber**, in *Gardening*, the common name of a wild sort of cucumber, which is sometimes cultivated in gardens for the sake of curiosity, and for the

the peculiar property which it **possesses of instantly bursting** the capsules of the ripe fruit, on being touched, with much elasticity and violence, so as to throw the juice and seeds which they contain forcibly to a great distance all around, to the great surprize of those who may have touched them. See **MOMORDICA**.

It likewise affords the medicinal substance known by the name of *elaterium*.

SQUIRZINA, in *Geography*, a town of the duchy of Warlaw; 50 miles W.N.W. of Posen.

SRADHA, the name of a ceremony among the Hindoos, of a very interesting and affecting nature; being obsequies in honour of departed ancestors.

The Hindoo Pantheon furnishes some particulars explanatory of this interesting and affecting ceremony, which, the author tells us, is an oblation of daily recurrence with Brahmans and rigid Hindoos who can afford it. It is offered not only in honour of deceased ancestors, but for their comfort; as the manes, as well as the gods connected with them, enjoy, like the gods of the Greeks, the incense of such offerings; which are farther of an expiatory nature, similar, it may be presumed, in their efficacy, as well as in the motives that induce them, to the masses of the Romish church. Over these ceremonies of Sradha, Yama presides, in his character of Sradhadeva, or lord of the obsequies. See **SRADHADEVA** and **YAMA**.

Mr. Colebrooke tells us (*Af. Ref.* vol. vii.), that the priests, in the performance of the Sradha, meditate the gayatri, and thrice repeat "Salutation to the gods, to the manes of ancestors, and to mighty faints; to Swaha (gods of fire) to Swadha (the food of the manes); salutation to them for ever and ever." Of the gayatri, &c. of this quotation, see **O'M**, **SWADHA**, and **SWAHA**.

M. le Gentil found a strong resemblance between the funeral rites of the Chinese and the Sradha of the Hindoos. On which Sir William Jones (*Af. Ref.* vol. ii.) says, "that all the circumstances which have been mentioned, under the two heads of literature and religion, seem collectively to prove, (as far as such question will admit of proof,) that the Chinese and Hindoos were the same people; but having been separated near four thousand years, have retained few strong features of their ancient consanguinity; especially as the Hindoos have preserved their old language and ritual, while the Chinese very soon lost both. And the Hindoos have constantly intermarried among themselves; while the Chinese, by a mixture of Tartarian blood from the time of their first establishment, have at length formed a race distinct in appearance from both Indians and Tartars."

In the third chapter of the *Institutes of Menu*, the rules for the performance of the Sradha are detailed with proximity. Among other particulars of the most important of those ceremonies, we learn that Brahmans only ought to be invited to the feast, which forms one important rite; and such Brahmans should be of holy and learned habits. A Sudra, that is, one of the fourth or servile class, is urgently prohibited as a guest. Let the housekeeper, it is said, who knows his duty, perform each day a Sradha with boiled rice, and the like, or with water, or with milk, roots, and fruit; for thus he obtains favour from departed progenitors, &c. &c. &c.

The following extract is taken from Colebrooke's *Dissertation on the religious Ceremonies of the Hindoos*, in the seventh volume of the *Asiatic Researches*; which article contains much valuable matter, and many curious particulars of the Sradha, or feast attending funeral obsequies.

"A dying man, when no hopes of his surviving remain, should be laid on a bed of Kusa grass (see **KUSA**), in the

open air, his head sprinkled with water drawn from the Ganges, and smeared with clay brought from the same river. A Salagrama stone (see **SALAGRAMA**) should be placed near him, holy strains from the Veda (see **VEDA**) should be chanted aloud, and leaves of holy basil scattered over his head.

"When he expires, the corpse must be washed, perfumed, and decked with wreaths of flowers, and carried by the nearest relations to some spot in the forest, or near water: the funeral pile is lighted from the consecrated fire maintained by the deceased. (See of this under our articles **SAGNIKA** and **SAMI**.) The nearest relation applies the flaming brand to the pile, hung round with flowers; and the attendant priests recite the appropriate invocations: 'Fire! thou wast lighted by him; may he, therefore, be reproduced from thee, that he may attain the regions of celestial bliss. May this offering be auspicious!' All who followed the corpse walk round the pile, but may not view the fire. They then proceed to the river, and, after bathing, present oblations of water to the manes of the deceased, saying, 'May this oblation reach thee!' Elegiac verses, such as the following, are then recited.

"1. Foolish is he who seeks for permanence in the human state; insolid, like the stem of the plantain-tree; transient, like the foam of the ocean.

"2. When a body, formed of five elements, to receive the reward of deeds done in its own former person, reverts to its own five original principles, what room is there for regret?

"3. The earth is perishable; the ocean, the gods themselves pass away: how should not that bubble, mortal man, meet destruction?

"4. All that is low must finally perish; all that is elevated must ultimately fall; all compounded bodies must end in dissolution; and life be concluded by death."

Exclusive of the daily Sradhas, or feasts, given by wealthy individuals, formal obsequies are performed ninety-six hours in every year, on particular days. "It should be observed," Mr. Colebrooke tells us, respecting the practice of giving food at these obsequies, "that Brahmans generally give it to one or more of their own relations. A stranger, unless indigent, would be very unwilling to accept the food, or attend at a Sradha, for the purpose of eating it. The use of flesh meat is positively enjoined to Hindoos at certain obsequies, and recommended at all. (See *Inst. of Menu*, c. iii. v. 124. 268, &c.) But the precepts of their lawgivers are, by some, deemed obsolete in the present age; and are evaded by others, who acknowledge the cogency of these laws. These commonly make a vow of abstaining from flesh meat, and consider that vow as more binding than the precepts here alluded to. Others, again, not only eat meat at obsequies and solemn sacrifices, but make it their common diet, in direct breach of their religion." It hence appears clear, that the idea so common in Europe, of the universal abstinence of Hindoos from flesh meat, is as erroneous as general. Some pages of the Hindoo Pantheon are devoted to prove this fact; and it is fully proved, that not only all Hindoos may, but that a great majority of those who can obtain it, including Brahmans themselves, actually do, eat meat.

The feast attendant on the ceremonies of the Sradha can be given only by the son, or grandson, or male issue of the defunct; and as the greatest importance is attached by Brahmans and others to the due performance of these ceremonies, default of male issue is deprecated as among the heaviest of misfortunes. The Hindoo books, therefore, abound in instances of the efficacy of prayers, sacrifices,

alms to Brahmans, pilgrimages, austerities, &c. in obtaining this grand object of comfort to departed souls. "Appeasing the manes," by the Sradha, is as common in the mind of a Hindoo, as relieving the pains of purgatory by masses is in that of a Papist. Though the ceremonies differ, the principle is strikingly similar. Being childless is felt as an angry visitation of the gods, inflicted partly for sins in a former state of existence: they are, therefore, propitiated by alms, pilgrimages, &c. One mode of removing sterility is by circumambulating an image, or tree, sacred to some deity. (Of this see under PRADAKSINA, the name of this ceremony.) If every thing fail, there is, however, still a remedy by adoption, accompanied by certain ceremonies, expensive, according to the means of the party. Another is by giving daughters in marriage with like ceremonies; all of which are minutely detailed in the ritual. For all these proceedings divine authority can be quoted. Holy men, or even divinities, in the times of their terrestrial sojournments, are related to have done the like. "He," says Menu, "who has no son, may appoint a daughter to raise up a son for him, saying, 'The male child who shall be born from her in wedlock shall be mine, for the purpose of performing my obsequies.'"

"In this manner Daksha himself, lord of created beings, anciently appointed all his fifty daughters to raise up sons to him, for the sake of multiplying his race."

SRADHADEVA, in *Hindoo Mythology*, a name given to the Pluto of their infernal regions. It means lord of the Sradha, a feast often, by many daily, offered in commemoration of deceased ancestors. (See SRADHA.) The more common name for the lord of the obsequies is *Yama*; which see.

SRAMANA, a name of the Eastern deity *Boodb*; which see.

Sakya, Sravaka, and Sugata, (which see,) are others of his names. So is Gotama, or Godama. The union of the first and last of these names, a little altered in the pronunciation, produced that of Somnecodom, by which he is called by some writers. See GODAMA.

SRAVAKA, the name of the laity of the Jainas, a sect of schismatic Hindoos. Their priests are called Yati. (See JAINA and YATI.) A name also of the god Budha, or *Boodb*; which see. For a notice of the religion and customs of the sect of Sravaka, see Moor on Hindoo Infanticide, p. 174. Among the Mahrattas, the Sravakas are called Shevari.

SRBORNICK, in *Geography*, a town of Bosnia; 40 miles N.N.E. of Bosnaferai.

SREDNEI, an island in the Frozen ocean, at the mouth of the Indigirda, about 40 miles in circumference, of a triangular form. N. lat. 72° 52'. E. long. 154° 155'.—Also, a town of Russia, in the government of Tobolsk; 20 miles N.N.W. of Tassievkoi.

SRI, in *Hindoo Mythology*, is a name given to several goddesses; oftenest perhaps to Lakshmi, the goddess of prosperity and abundance. This name is in the first case Sris, which sir William Jones remarked as resembling, both in name and character, the goddess of abundance of the Latins; and he says, that in very ancient temples near Gaya there are images of Lakshmi, with full breasts, and a cord twisted under her arm, like a horn of plenty, which looks very much like the old Grecian and Roman figures of Ceres. (See LAKSHMI.) The word Sri, however, although given as a name or epithet to the Ceres of India, and to the other great goddesses Parvati and Saraswati, is not confined to them: it means fortunate, happy, &c. as well

as blessed or divine; and is sometimes prefixed to the names both of gods and men.

SRI BHAGAVATA, the title of a work in the Sanscrit language, of great celebrity among the Hindoos. It is usual to ascribe this work to Vyasa, the reputed compiler or author of the Vedas, Puranas, Mahabarat, and other works. But the real author of the Sri Bhagavata is Vopadeva, who, in attempting to revive the leading doctrines of Vyasa, opened a door to the reconciliation of the various sects of Hindoos, numerously divided and subdivided as they are, and, as far as historical evidence can be traced, ever have been. We must refer the reader to our article SECTS of Hindoos, for farther information on these points. (See also VYASA.) Under our article PURANA we have given a succinct account of the mythological romances so called, that are so highly venerated in India as inspired poems. Of these the Sri Bhagavata is reckoned the eighteenth and last; and whatever differences of opinion may exist, and very wide differences do exist, as to the antiquity and form of the other Puranas, it seems a point generally agreed on, that the Bhagavata is much more modern than the rest, and cannot, in its present form, claim an age of more than six hundred years.

The main subject of the Bhagavat is the life and actions of Krishna; including the extravagant and mystical details of his incarnation, miracles, debaucheries, and various fooleries; intermixed, however, with sublime effusions of pure theology and morals. (See MYSTICAL Poetry.) Like most of the other respected writings of the Hindoos, it contains much to applaud and admire; but more, whether viewed philosophically or morally, to reprehend. It is comprised in twelve books, and, like the other poems bearing the common denomination of Purana, contains, besides the general thread of sectarial theology interwoven throughout, five subjects, viz. primary creation, or creation of matter in the abstract; secondary creation, or the production of subordinate beings, both spiritual and material; chronological account of their grand periods of time called Manwantara; genealogical rise of families, particularly of those who have reigned in India; and, lastly, a history of the lives of particular families.

This work is in general estimation, and is found in most of the vulgar dialects of India, and in the Persian language. It has also appeared in a very imperfect and abridged form, in French, under the title of Bagavadam, translated from the Tamul version. Its title is derivable from Bhagavan, one of the names of Krishna and Vishnu; and Bhagavan from Bhaga, meaning, it is said, the author of existence, or lord of nature. (See SIVA.) Sri is a prefixure of respect, extensively applied. (See SRI.) The modern sect, who adhere to the liberal doctrine expounded in this work, are called Bhagavatas. But we must again refer to our article SECTS of Hindoos, for an explanation of the nature of the Hindoo sectarial distinctions. See also KRISHNA, for an account of the hero of the Bhagavat.

SRI DEVI, in *Hindoo Mythology*, is a name given by several sects to the goddesses of their adoration; such individual goddesses being called the fakti, or energy of her lord. In explanation of this, we refer to our article SAKTI. Sri-devi means the blessed goddess, and is given to all the three great goddesses, Lakshmi, Parvati, and Saraswati.

Sridevi is likewise the name of the wife of Daksha, who was Brahma in a human shape. In this character she seems to be both the daughter and mother of Parvati. See PIKE-SWARI and SRADHA.

SRIMANA, a name of Kartikya, the Hindoo regent of the firmament. See KARTIKYA.

SRIMANT, an appellation of respect used in the third person to the Peshwa, or chief person of the Mahratta empire. See PESHWA.

SRINAGUR, in *Geography*. See SIRINAGUR.

SRIPADA, a name, or word, used among the Hindoos, meaning a divine footstep, for which supposed impressions they have a very reverential feeling. On the top of the lofty mountain on the island of Ceylon, which European geographers call Adam's peak, the Hindoos fancy there is a fripad; and accordingly pilgrimages are made to it from distant parts of India. Vishnu, it is said, alighted on this spot, and left the holy and indelible impression. In the neighbourhood of temples, or at their threshold, it is not unusual to see a flat stone embossed or engraved with the impression of two feet, joined from heel to toe; such being the attitude of adoration: and it is said that such stones are the last terrene substance pressed by the feet of the unhappy victims of superstition, who burn themselves alive on the pile of their husbands. They step from these flat stones upon the pile, and then appertain more to the next world than to this. The next step is into the presence of the gods; or, in the case of temples, to their holy place.

The Hindoos are not the only people who have a veneration for the mystical impressions of feet. The fripad above mentioned on Ceylon was said by our early zealous missionaries to have been left by Adam; they endeavouring to establish the fact of that chosen island having been the Eden of our first parents. (See LANKA.) In the holy land, miraculous fripada, or footsteps, are still shewn and revered, as left by the last pressure of our Saviour on the earth. On this subject the reader will find some interesting discussion in Dr. Clark's Travels, vol. ii. p. 584.

SRIRANGA, a name of the Hindoo god Siva. The name is Ranga, with the epithet Sri prefixed, meaning holy or blessed. (See RANGA, SIVA, and SRI.) Seringapatam, or Seringapatana, means the city of Sriranga, or of the holy Ranga.

SRIVIRUPAKSHA, a name of Siva, the destructive or transforming power of the Hindoo divine triad. Virupaksha is said to mean with *three eyes*, Siva being so gifted; and hence named *Trilokan*; which see. (See also SIVA.) An eminent Sanscrit scholar translates the name Virupaksha, "with a disagreeable countenance." The epithet Sri prefixed means blessed or divine. See SRI and VIRUPAKSHA.

Madame Dacier, in a note on the ninth book of the Iliad, has a passage applicable to the mythological subject of this article. The ancients, she says, gave the name of Jupiter not only to the god of heaven, but likewise to the god of hell, as is seen here by the epithet of "infernal Jove," and to the god of the sea, as appears from Eschylus. They thereby meant to shew, that one sole deity governed the world; and it was to teach the same truth, that the ancient statuaries made statues of Jupiter, which had three eyes. Priam had one of them in that manner in the court of his palace, which was there in Laomedon's time. After the taking of Troy, when the Greeks shared the booty, it fell to the lot of Stenelus, who carried it into Greece.

Siva, the Indian Jove, is, in like manner, deemed variously the god of the three regions of the universe, as denoted by his three eyes, trident, &c. See PARVATI and TRISULA.

SRODA, or **SVODA**, in *Geography*, a town of the duchy of Warfaw; 14 miles S.E. of Posen.

SRSEM, or **STRIM**, a town of the duchy of Warfaw; 20 miles S. of Posen.

SRSERED. See SERAT.

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SSE-TCHUEN, a town of Corea; 33 miles S.W. of Tsin-tcheou.

SSIDA, a town of Japan, in the island of Nippon; 18 miles S. of Fitaqua.

SSIERSCH, a town of the duchy of Warfaw; 16 miles N. of Ploczk.

SSOKAL, a town of Austrian Poland, in the palatinate of Belz; 10 miles N.E. of Belz.

SSUUS, a town of Japan, on the N. coast of Nippon; 20 miles S.E. of Noto.

ST, an indeclinable term, chiefly used to command silence. The Romans had these two characters written over the doors of the eating-rooms, as who should say, *sed tace*, or *silentium tene*.

Porphyry observes, the ancients made a point of religion of it, not to speak a single word in passing in or out of the doors.

STAAL, *Madame de*, in *Biography*, an ingenious French writer, first known by the name of Mademoiselle de Launay, was daughter of a painter at Paris. Her father being obliged to quit the kingdom, she was left in a state of poverty. She had enjoyed the advantages of a good education at a priory in Rouen; but her patroness dying, she was under the necessity of engaging herself as bed-chamber woman to the duchess of Maine; who soon discovering the talents of her servant, employed her in all the theatrical entertainments which she gave at her seat of Sceaux. For some of these De Launay wrote verses, and for others she formed the plans, and thus obtained the perfect and unlimited confidence of her mistress, and the friendship of all the men of wit and letters who frequented that court. Following the fortunes of her mistress, she was involved in the disgrace incurred by the duchess during the regency of the duke of Orleans, and was two years a prisoner in the Bastille. After her liberation, the duchess, as a reward for her fidelity, married her to M. de Staal, lieutenant, and afterwards captain, in the Swiss guards. From her own description, she appears to have possessed few personal attractions, yet her gallantries were a great source of the vexations with which her life was disquieted. She sometimes loved without a return, and she sometimes attracted attentions to which she paid no regard. She died in 1750, and after her death were printed, in 3 vols. 12mo. "Memoirs of her Life," written by herself. These are agreeably written, and in a pure and elegant style. There has been added a fourth volume, containing two comedies acted at Sceaux, entitled "L'Engoument," and "La Mode," the chief merit of which is said to consist in the sprightliness of the dialogue. Her memoirs have been translated into the English language.

STAATEN LAND, in *Geography*. See *New ZEALAND*.

STAATSBERG, an opulent farming neighbourhood in Clinton, Duches county, New York, in which is a post-office; 70 miles from Albany, and 10 from Poughkeepsie.

STAATZ, a town of Austria; 5 miles W. of Falkenstein.

STAAVIA, in *Botany*, was so called by Dahl, in compliment to Mr. Martin Staaf, of Gottenburgh, a great patron of botany, and an assiduous disciple of the great Linnæus, to whom he formerly communicated many natural productions from China.—Dahl. Obf. Bot. 14. Thunb. Prodr. 41. Willd. Sp. Pl. v. 1. 1144. Ait. v. 2. 35. Poiret in Lamarek Dict. v. 7. 363. (Levisanus; Schreb. Gen. 149, excluding the reference to Gärtner.)—Class and order, *Pentandria Monogynia*. Nat. Ord. *Rhamni*, Juss.

Gen. Ch. *Common Calyx* hemispherical, many-flowered, 4 P imbricated,

imbricated, of numerous linear leaflets. Perianth superior, erect, of one leaf, in five deep acute segments, permanent. Cor. Petals five, short, oblong, obtuse, nearly upright, with slender claws. Stam. Filaments five, awl-shaped, inserted into the bottom of the calyx; anthers roundish. Pist. Germen inferior, turbinate; styles two, combined, capillary; stigmas simple. Peric. Berry coated, of five cells. Seeds solitary. Common Receptacle convex, villous, or chaffy.

Ess. Ch. Flowers aggregate. Stamens inserted into the calyx. Styles two, united. Berry coated, with five seeds. Common receptacle chaffy.

1. *S. radiata*. Rayed Staavia. Willd. n. 1. Ait. n. 1. (*Brunia radiata*; Linn. Mant. 2. 209. *Phyllica radiata*; Linn. Sp. Pl. 283. *Chrysanthemum ericoides coronatum*; Breyn. Cent. 165. t. 82.)—Leaves lanceolate-triangular. Coloured rays of the calyx shorter than the diameter of the head of flowers.—Native of the Cape of Good Hope. A greenhouse plant in England, flowering in May and June, but of no striking appearance. The straight hairy branches of the bushy stem are clothed with numerous, little, alternate, heath-like, smooth, glaucous leaves, on short stalks. The flowers are corymbose, four or five together at the summit of each branch, looking not unlike some small kind of *Aster*. The disk is a quarter of an inch broad, reddish. Rays nearly the same in length, pale, obtuse, recurved.

2. *S. glutinosa*. Clammy Staavia. Willd. n. 2. Ait. n. 2. (*Brunia glutinosa*; Linn. Mant. 2. 10.)—Leaves linear-triangular. Coloured rays of the calyx rather longer than the diameter of the head of flowers.—From the same country. Introduced into England by Messrs. Lee and Kennedy in 1793. We find no figure that can be trusted, though Plukenet's t. 431. f. 1. bears some resemblance to this species. The leaves are longer and more slender than the foregoing. Flowers solitary, full twice as large, with copious, long, and slender rays. The disk is glutinous, perhaps from abundance of honey, and is covered in the dried specimens with sand, whence the name.

STAB, in *Geography*, a town of Bohemia, in the circle of Pilsen; 11 miles S.S.W. of Pilsen.

STABAT *Mater Dolorosa*. This celebrated elegy in monkish rhymes, written about the 14th century by Jacoponus, a minor Franciscan friar, has been set by all the great masters in Italy, and Roman Catholic composers in Germany; but by none in so happy and captivating a manner as by Pergolesi.

STABBIA, in *Geography*, a town of Etruria; 11 miles S.S.W. of Pistoia.

STABBING, in *Law*. See MANSLAUGHTER.

STABBING of *Hoven Cattle*, in *Rural Economy*. See HOVEN.

STABILI SUONI, in the *Ancient Greek Music*, were the extremes, or lowest and highest sounds of each tetrachord, which, sounded together, constituted the diatessaron, or 4th, that was never changed as the two middle strings were, which were elevated or lowered according to the genera, and on that account were called *mobiles*, *mobili suoni*.

STABLE, in *Rural Economy*, a building or house constructed for horses and other animals, being furnished with stalls and proper contrivances to contain their food and other matter.

Nothing conduces more to the health of a horse than the having a good and wholesome stable. The situation of a stable should always be in a good air, and on a firm, dry, and hard ground, that in winter the horse may come in and go out clean. It should always be built somewhat on an ascent, that the urine and other foulnesses may be

easily conveyed away by means of drains or sinks cut for that purpose.

As there is no animal that delights more in cleanliness than the horse, or that more abominates bad smells, care should be taken that there be no hog-stie, hen-roost, or necessary-house, near the place where the stable is to be built; for the swallowing of feathers, which is very apt to happen when hen-roosts are near, often proves mortal to horses; and the steams of a hog-house, or hog's dung, will breed many distempers; and particularly they will bring on the farcy and blindness in many horses. It is much better to build the walls of a stable of brick than of stone, for the former is always dry, the other often sweats, and is very apt to be damp, and to cause rheums and catarrhs to horses that are fet in the stable in damp weather.

The walls ought to be made of a moderate thickness, both for the sake of safety, and warmth in winter, and to keep off the heat of the sun in the midst of summer, which would spoil the horse's appetite, and sink his spirits. The windows should be made on the east and north sides of the building, that the north air may be let in to cool the stables in summer, and for the benefit of the rising sun all the year round, especially in winter.

The windows should either be lashed, or have large casements, for the sake of letting in air enough; and there should always be close wooden shutters, that the light may be shut out at pleasure; by which means the horse will be brought to sleep in the middle of the day, as well as in the night, when it is judged proper that he should do so.

Many pave the whole stable with stone; but it is much better to have that part which the horse is to lie upon, boarded with oak-planks; for it will be not only easier, but more warm and comfortable to the animal.

The boards must be laid as even as possible, for this is the way to make the creature lie most at his ease, and in the most healthful posture. The dealers in horses generally, indeed, make the boards be laid higher toward the top, and slanting down: this shews a horse to more advantage as he lies, but it is very uncomfortable to the creature, and his hinder parts are always slipping down, and the hind legs are often made subject to swellings by it.

The planks should be laid crosswise, not lengthwise; and there are to be several holes bored through them to receive the urine, and carry it off underneath the floor into some drain or common receptacle. The ground behind should be raised to a level with the planks, that the horse may always stand even, and the floor behind should be paved with small pebbles, and the place where the rack stands should be well wainscotted. There are to be two rings placed on each side of the stall for the horse's halter to run through, and a logger is to be fixed to the end of this, sufficient to poise it perpendicularly, but not so heavy as to tire the horse, or to hinder him from eating. The best place for him to eat his corn in is a drawer, or locker, made in the wainscot partition; this need not be large, and consequently need not take up much room, so that it may be easily fixed, and taken out to clean at pleasure; by this means the common dirtiness of a fixed manger is to be avoided.

Many people are against having a rack in their stables; they give the horse his hay sprinkled upon his litter, and if they think he treads it too much, or too soon, they only nail up three or four boards, by way of a trough, to give it to him in. The reason of this is, that the continual lifting up of the head to feed out of the rack is an unnatural posture for a horse, which was intended to take his food up from the ground, and makes him, as they express it, withy-cragged.

eraged. In the way of sprinkling the hay on the litter, or laying it in a trough even with the ground, he not only takes it up as if from the earth in a natural way, but can eat as he lies, which is a kind of indulgence, that a horse takes great pleasure in.

It is proper, however, in most cases, to have some sort of rack, or other contrivance, for the purpose of containing the hay, or other sort of fodder which the horse may want, and from which he might eat it with ease and convenience to himself. The best and most economical kinds are probably those which are placed in an upright manner in recesses in the walls, or in the corners and angles of the stalls.

When there is stable-room enough, partitions are to be made for several horses to stand in; these should always allow room enough for the horses to turn about, and lie down conveniently in, and they should be boarded up so high toward the head, that the horses placed in separate stalls may not be able to smell at one another, nor molest each other any way. One of these stalls ought to be covered in, and made convenient for the groom to lie in, in case of a great match, or the sickness of a valuable horse. Behind the horses there should be a row of pegs to hang up saddles, bridles, and other necessary utensils; and some shelves for the hanging up brushes, &c. and the standing of pots of ointment and other preparations.

The stables of the nobility are often incommoded by bins for oats placed in them, which take up a great deal of room with very little advantage. Dr. Plott has given us, in his History of Oxfordshire, a very convenient method, used by a gentleman of that county, to prevent this. It is done by making a conveniency to let the oats down from above, out of a vessel like the hopper of a mill, whence they fall into a square pipe of about four inches in diameter, let into the wall, which comes down into a cupboard also let into the wall, but with its mouth so near the bottom, that there shall never be more than about a gallon in the cupboard at a time; which being taken out, and given to the horses, another gallon immediately succeeds it from above, without any trouble to the groom or any body else. By this means there is not an inch of room lost in the lower part of the stable where the horses stand: and there is this great conveniency beside, that the oats are always kept sweet by it, for every gallon that is taken away puts the whole quantity above in motion, by the running down of the gallon that supplies its place, and no mustiness ever comes where there is this continual airing and motion. There may easily be contrived two of these, the one for the oats, the other for split-beans; and both of these may be let into the range of presses, the oats and beans being separated above by partitions. The other requisites for a stable are, a dung-yard, a pump, and a conduit; and if some pond or running river be near, it is much the better.

But with regard to farm-stables, it is not, however, necessary to attend so much to elegance in their construction as in the above cases; it is sufficient to have them neat, handy, and convenient. And in order to this, they should be situated so as to be contiguous to the other offices, with which they may have the greatest connection or relation.

It has been observed by Mr. Bealton, in the first volume of Communications to the Board of Agriculture, that in the contriving and fitting up of the racks and mangers in these buildings, great attention should be had to economy and the convenience of labour. The most common and usual method of making them, so as to extend quite across the upper end of the stall, is a bad and expensive practice, and which has much inconvenience in the foddering of the horses; as,

in order to save trouble, servants are very apt to fluff the racks full of hay, however large they may be, from which many bad consequences arise, and much hay is lost or destroyed by being pulled down and mixed with the litter, or trodden under the feet of the animals. Besides, various bad effects result from the practice of suffering horses to be continually stuffing themselves with hay, as is well known to those who are accustomed to the proper management of such animals; as under their directions they are never permitted to have much hay in their racks at a time. Another disadvantage also attends this mode of fitting up stalls, especially for farm-horses, as it ought to be the object to preserve every thing; the hay-seeds are totally lost, which, if good, and carefully secured, might be of great utility and value. And by the practice of placing the racks with so much inclination outwards, the seeds are also very apt to fall into the horse's ears and eyes, which often cause disagreeable effects. For these reasons, it is supposed that racks should have a perpendicular direction, not having a space of more than fourteen or sixteen inches from the wall; the bottom being sparred, in order to let the seeds fall down through below, whence they may be removed by a sort of sliding shutter. These advantages may also be neatly and conveniently obtained by leaving niches in the walls for the racks, on which plan the spars will be equal with the insides of the walls. Where the niches and racks are made in the middle of the stalls, two feet, or two feet and a half wide, will in most cases be sufficient; they should, however, be carried down low enough to admit of a small box or drawer being placed under them, for the reception of the hay-seeds. Racks of this sort may likewise be placed in the corners of the stalls, and be made in such a way, as that one niche may serve two stalls. And they may be placed in the angles of the stalls without having any niche, and may be made of a semicircular form. But in whatever way they are formed, there should constantly be a division betwixt them, which is probably best made of deal. Where the racks are put in the corners of the stalls, it may, perhaps, be more advantageous to have them straight than circular; but in whichever way they are formed, the farmer should always have a hatch fixed for each stall, as by that means a great deal of time may be saved in feeding his horses.

If the above methods be adopted, it must be unnecessary to make a manger of the same width with the stall; as a box or drawer, sixteen or eighteen inches long, and twelve or fourteen inches wide, will answer every intention perfectly well. But it should be so contrived that it may be readily taken out and cleaned whenever it is fouled, or becomes furred with dirt. With the fixed mangers this can never be done.

Besides this, there is another method of making stalls, which, as being cheaper and more economical, deserves to be regarded by the farmer: on this plan the stable has neither racks nor mangers; the head of the stall is boarded about three feet from the ground, having a space of about two feet from the wall, in which the hay is to be deposited, the horse pulling his hay from below, instead of drawing it from above; which is not only more natural, but prevents the waste of hay, much of which drops down and is lost when the horse eats from a rack. But even in this construction, it will be necessary to have the bottom sparred within eight or ten inches of the ground, and a box, hopper, or hay-manger and drawer, so contrived as to receive the seeds of the hay: where there are double stalls, the boxes may be divided in the middle. Single stalls, where they can be conveniently made, should, however, always be preferred, as

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being much more safe and convenient in different points of view, both for the horses and persons employed about them.

Further, it is likewise conceived, that the paving of stables is a matter of great importance, though it has been hitherto but little attended to: whether the stall should have a slight declivity, or be perfectly level, has not, perhaps, yet been so fully determined as it ought. It would appear, however, to be more natural and easy for these animals to stand and rest themselves on a level surface, than on one that is sloping, as it is evident that the tendons or sinews of the pastern joints must be kept more upon the stretch in the latter than in the former case. The main difficulty in regard to a level stall has been the conveying away of the moisture; but this may be well effected by paving the stall perfectly level, and only leaving a small drain in the middle, extending within two or three feet of the upper end of the stall; but which should not be more than seven or eight inches wide at top, forming an angle at the bottom. The depth at the end nearest the head of the stall need not be more than three or four inches deep, having as much slope as can be conveniently given it backwards, in order that it may carry the moisture off quickly to the main drain, into which all the stall-drains should have a fall, and the moisture be discharged. And the small stall-drains must also be covered with a piece of good strong oak-plank, in which a great number of holes are bored, and which must be so fattened, as to admit of its being readily raised up and let down; as by this means the drains may be washed, and kept clean and sweet, as often as they are found to be furred up and obstructed. And besides these, main drains must be made at the end of the stalls, or in some other convenient situation, for carrying off the moisture into the general receptacle. Where they are placed at the bottoms of the stalls, they should not be closer to the stalls than two feet, in order that the stale of mares may get readily into them, which would not be the case if they were nearer, unless the pavement behind the stalls was made to decline a little towards them. These main drains need not be more than seven or eight inches wide at the top, but they should be covered with plank, in which holes are perforated for conveying away the moisture and wetness. But with the view of saving the expence of making main drains within the stable, a shallow open drain may be made in the common way, with which the stall-drains may communicate by means of very small grates at the ends. And it should be observed, that the pavements or floors of the stalls should have a very slight declination from their sides towards the drains, to prevent moisture standing on them; an inch, or an inch and a half in the whole, will, however, be quite sufficient for these purposes.

It may be noticed, in regard to the sizes of stalls, that they differ much according to circumstances; but four feet and a half in width are the least they should ever be made, and five feet are much better. The divisions between them should be high, so that strange horses may not see each other. But where stallions are kept, or young horses required to be left loose in a stall, they should be so inclosed as to be incapable of doing mischief. And for these purposes, one or more stalls may be sparred to the top, or doors provided, which may be hung to the back posts of the stable. Where this last method is followed, the stalls serve extremely well for keeping different mares and their foals separate from others, as well as many other useful purposes in the business of horse-management with the farmer.

But the writer of the East Lothian Agricultural Survey

has remarked, that sometimes stalls are made double; and as farm-horses generally work in pairs, each pair that work together have one of these double stalls; for horses are social animals, and it is said they feed better, and are more cheerful, when they live in society. But even in this case it is proper they should be fastened to the opposite sides of the stall, and that each horse should have his own rack and his own manger; for although they may seem to have a very great attachment to each other, yet if the dividing of their food is left to themselves, it is more than probable they will quarrel about it, and that the strongest horse will have the best share. But such farm-stables as contain only one row of stalls, with one horse in each stall, are, on the whole, the most useful and convenient; and if the stalls are sufficiently large, and the divisions between them raised sufficiently high, not with spars, as often is the case, but with boards closely joined, each horse will be allowed to eat his proportion of corn and hay equally, and allowed to take the necessary rest, without danger of being disturbed; by a troublesome neighbour. The stable ought to be well paved, and of a sufficient breadth, to leave a space of at least six or seven feet behind each horse, for a safe passage to the servants in hanging the harness upon the wall, &c. The pavement should decline very gradually from the horse's head backwards, towards the channel at his heels, which should also decline, in the same gradual manner, towards one end of the stable, where the urine may be received into a reservoir. Proper openings should also be left in the walls, for the purpose of ventilation; these should be fitted with sliding or flap-boards, opened in the morning, when the horses go out to work, and shut in the evening: in this way the stables will be properly ventilated; and every risk of cold, from having these openings uncovered during the night, be avoided.

The smell of a stable, where the dung has been allowed to remain for a week or ten days, is intolerable; and the volatile alkali generated is so strong as to penetrate and affect both the eyes and noses of persons entering into it, in a very disagreeable manner. The consequence is, the horses are sickened and enervated by the heat and offensive smell during the night; a part of their food, being impregnated with the effluvia, is loathed and rejected; and, in the morning, when they are taken out to work, instead of the sprightly appearance exhibited by animals that have been well fed and had a comfortable bed, their hanging ears and heavy sluggish appearance distinctly mark the state of the stables they have quitted.

However, in order to render the forming and constructing of the different internal parts of stables more clear and easy, it may be necessary to have recourse to some account and explanation of them. In the old common and usual modes of placing the racks and mangers in stables, as in some measure suggested above, the former are mostly put in a slanting outward upward direction, so as that the top parts of them may have a projection or space of two feet or more from the walls, while the lower parts rest against them. The latter are constantly placed a little below and underneath them, mostly extending quite across the stalls. In these modes of fixing these internal parts of stables, there is seldom or ever any sort of contrivances for either preserving the feeds, or preventing their falling upon the heads of the horses, while they are eating. Nor is the hay, or other fodder, guarded against being pulled out, trodden under foot, and wasted by the animals. They are consequently very uneconomical in their nature and consequences.

But in the improved methods of placing these internal parts,

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parts, the positions of the racks, as well as the nature, dimensions, and other circumstances of the mangers, are quite different. In some cases, the racks are fixed about fourteen inches from the walls, with but very little, if any, slant; having their bottom parts laid with small spars, or thin narrow pieces of wood, in an open manner, so that the hay-seeds can fall down through between them, and be received in a drawer, or box, made for the purpose below, where they are capable of being drawn or taken out at pleasure. A small box, or trough, is placed in some convenient part, answering the purpose of a manger, and which is sometimes made as a drawer, to put in and draw out as there may be occasion. The divisions of the stalls sometimes rise pretty high at the head parts, in the ordinary way; and, at other times, in a curving manner at the upper ends, from the tail-posts to nearly the ceilings of the stables; and flap-doors, the height of the lower parts of the divisions, are sometimes fastened with hinges to posts, or the walls behind the horses.

In other instances, the racks are placed in half-circular niches or recesses in the walls of the stables, opposite the divisions of the stalls; each niche being made to serve two stalls, by having a division in the middle betwixt them; and the racks themselves are sometimes made in half-circular forms. The same kind of half-circular racks are occasionally, also put in the angles or corners of the stalls, without any niches; there being divisions between them, so as that they may serve two stalls: but the racks, in these cases, have not always the half-circular form, but are made and fixed up in a straight manner.

In all these cases, small drawers or boxes serve as mangers, for the horses to eat their provender out of, as may be necessary. There are some few other modes of fixing up racks and mangers in stables, as will be seen below; but these are probably the most eligible and convenient, as well as the most economical and least expensive in their nature and means of putting up.

The manner of fixing the window and the shutters in the windows of stables is important in several respects, as they contribute much to the proper regulation of the atmosphere and state of heat in them, as well as to other matters. They are both probably the best and most convenient, when suspended and balanced upon two iron pins, fixed in the middle parts of them, so as to render them capable of turning and standing in either or any direction, and to be readily wholly removed, in case of necessity. When the windows are made to slide up and down, the shutters may also be fixed in this way with advantage and good effect. By these means the air may be easily let out or in, and be regulated in an exact manner, which will be of much advantage in different cases and circumstances of stable management. There is sometimes a hopper sort of contrivance in stables, where neither racks nor mangers are employed, which is broad at the top, and has about fourteen inches width in the bottom part; being sparred, in order that the seeds may drop through into a drawer made for the purpose below. In each corner there is a small box for corn, which serves as a manger; the hopper part being divided in the middle, so as to serve two stalls as hay-mangers. This is a neat and convenient mode in some cases, though rather expensive in making and putting up.

There are still other contrivances in fitting up racks and stalls for preventing the unnecessary waste of labour and food, as well as to guard against the inconveniences of hay-seeds falling into the eyes and ears of horses, which have been suggested by experienced farmers in other countries. In one set of contrivances in this intention, the racks are placed in an upright manner, and the perpendiculars of

them are made to fall on the inner edges of the troughs below, which have shelving leaves. In these cases, when the animals pull out the hay from the racks, the waste parts fall on the leaves, and thus slide down into the troughs, where they are secured from being spoiled by the breath of the horses; while the distance between the bottoms of the racks and the troughs is quite sufficient for the admission of the heads of the horses, so as that they may get at the hay which is dropped. The racks, in these cases, are two feet four inches in depth, and two feet at top from the edge parts of them; being planed within, in order that the hay may fall to the bottoms of the racks gradually, in proportion as it diminishes in quantity, and the animals be saved the trouble of a long reach, which they are often obliged to make in the stables which are fitted up in the old usual manner. The animals are fed and supplied with the fodder from the entry, which is six feet in width; the hay being dropped through a trap-door from the store-room above the stable. This plan is the suggestion of Mr. West, an intelligent North American farmer. Another plan in the same intention has been proposed by Mr. Cooper, of another part of the same country, in which the racks of the stalls of the stables have a somewhat different construction and position, being formed with what are called *flats*, or thin strips or pieces of wood. In these the advantages are supposed to be very great, as the upright flats prevent the horses from walling the hay, as well as from blowing upon it: and besides, the animals are prevented from looking round, a habit to which horses are much accustomed when any person enters the stable; neither can they thrust their heads over the troughs, as the flats compel them to feed directly over them, without turning to either side. This mode of fitting up the stalls of stables may be found of much utility, in different situations and circumstances, in the management of both saddle, farm, and team-horses.

Very great utility and saving in point of duration may not unfrequently be produced, by having the internal and some other parts of the mangers and boxes, or other contrivances from which the horses eat their feeds of corn and other provender, lined and plated, or cased with different metallic substances. At Holkham-Hall, in the county of Norfolk, Mr. Coke has his mangers themselves, it is said by the writer of the corrected agricultural account of that district, plated with sheet-iron; and the front edges, which are rollers, covered with tin-plates. The bottoms of the stall divisions are likewise made of slate. It has also been found that for stables, as well as all other offices, those locks which have copper wards are the best, as being much more durable than any other kinds.

Stables, or the lofts over them, for saddle as well as for farm, team, and carriage-horses, are also not unfrequently fitted up and provided with different sorts of machinery and contrivances for preparing and reducing the different articles of food, which such horses are to have, into the most proper, convenient, and economical forms, for their being given to and consumed by them. These are, for the most part, straw or chaff-cutters, bean, barley, or malt-crackers, and oat-crushing and bruising machines. Such contrivances are often of very great utility and convenience, when properly managed, and put up in such stable buildings, or the rooms connected with them; and particularly where other more valuable uses are to be made of straw, pea and bean-haulm, and other similar materials, than that of merely littering animals. They are likewise useful in saving much labour, by their being always ready and at hand for performing these different necessary operations, as well as in several other ways.

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This sort of machinery is arranged and placed in a variety of different ways, according to the circumstances of the different cases. In a two-stalled stable, paved in the manner which is directed above, or in that which has been recommended by a writer in the first volume of Communications to the Board of Agriculture, a very simple and convenient apparatus has been contrived for working a chaff-cutter and a bean and barley-cracker, situated in the upper part of it, by the Rev. Mr. Froud, of Dartington Parsonage, in the county of Devon, merely by the power of one horse. It consists, according to the writer of the corrected agricultural account of the husbandry of the above district, of a block of oak sunk in the ground below the stable, with a perpendicular shaft or stem passing through the hay-loft floor, upon the top of which is fixed a crown-wheel of two-inch elm-plank, with six cast-iron segments, so as to compose a wheel of this sort of one hundred and eight cogs. There is also a pinion-wheel with fourteen cogs, the shaft of which passes through a drum, which is eighteen inches in diameter. From this drum the motion is communicated by a belt to the barley-cracker, and by the same belt to the chaff-cutter, where it is drawn tight over a sheave of eighteen inches in diameter. The barley-cracker has likewise a fly-wheel, and a wooden hopper for receiving the grain. The lever by which this machinery is worked, and which passes through a mortise made in the lower part of the shaft, makes, it is said, the division of the stalls of the stable, when tied or fastened to the mangers and other parts.

Stables may, however, be accommodated with these sorts of necessary machinery in other ways and manners, perhaps, with equal, if not greater, convenience and benefit than as above; as by having them put up in particular parts of such buildings exclusively appropriated for them, and the materials which they are to work upon; or by placing them in distinct separate erections constructed purposely for them, and such matters in immediate connection with the stables. By either of these means every possible advantage may be gained, without the horses being so much disturbed as in the preceding method. Besides, the materials which are to be operated upon may be a great deal more amply provided, and much better stored up and secured; and there will be far more extent for the fixing up and working of such sorts of machinery, as well as more room and convenience provided for putting by the different cut and prepared substances as food for the animals: and above all, a confidential servant can have the command and control of such situations, without interfering with the general management of the stables in such instances, especially where there is a proper corn and provender bin arranged somewhat in the manner that is suggested below; by which method a vast waste and loss of expensive food may, in different cases, be guarded against, and the machinery be wrought with a great deal more effect and security.

Stables for all sorts of saddle-horses, as well as for those of the light carriage kinds, should constantly be raised, constructed, and fitted up in a neat, warm, and sometimes, in particular situations and circumstances, in a rather elegant manner; as such sorts of horses can never be made to look so sleek and well in their coats as they ought to do, without the stables in which they are kept are in some degree warm and comfortable. And near the seats and residences of persons of distinction, handsome stables have an ornamental effect, in conjunction with the other sorts of offices and buildings, which is mostly desirable, and which should seldom or ever be overlooked or neglected in the plans and distributions of the office-buildings, in such cases. The

particular manner in which such stables are to be built must be left to, and regulated by, the tastes of the proprietors, and the peculiar nature and circumstances of the situations; but in the external walls, effect should almost always be well considered and attended to, while the necessary warmth and security are provided in an effectual and proper manner.

In the stalls, and the modes of fitting them up in these kinds of stables, the same sort of neatness, elegance, and ornamental effect, should, for the most part, be carefully preserved and kept in view; though, in some cases, this need not be so very much regarded. In the former, or stalls, there should constantly be a sufficiency of capacity or size, as already suggested, in order that the animals may not be too greatly confined, and that full room may be given for performing the various daily operations that are necessary about them. The latter, or the fitting up of the stalls, may be variously regulated and executed, according to the different methods and rules which have been laid down above, and the particular taste of the owners; having a constant regard to neatness, ornament, convenience, and economy, in the distribution of the different kinds of food and labour which are necessary, and to be performed about them.

In the construction of stables for farm and most sorts of heavy team-horses, a much less attention and regard to neatness will always be requisite and proper; and any sort of elegance or fineness in such cases must invariably be useless, absurd, and improper. In the building and contriving of these sorts of stables, convenience and the health of the animals are the principal circumstances which deserve to be materially considered and regarded. In the external inclosing materials for such stables, any sort which can afford the necessary warmth, shelter, and security, and which are at the same time cheap, will be proper for the purpose. The stables for these uses need seldom, if ever, be raised to such heights as those for other sorts of horses; nor need they always have lofts over them, or, at least, over the whole of them; though some extent of loft is mostly desirable, and often of considerable utility, for containing provender for the horses in a convenient and readily applicable manner. A small extent or proportion will, however, mostly answer the purpose very effectually, when properly arranged and fitted up in such intention; by which a very considerable saving of expence may not unfrequently be made.

The arrangement of all such stables must be according to the nature and circumstances of the farms, and purposes for which they are intended. The single range or row mode, which has been already noticed, is very good, in many instances; but they may be quite differently arranged, placed, and situated, in other cases, with equal or more advantage; and sometimes, under particular circumstances, stables with double rows of stalls may be found beneficial on farms, and for other uses. In fitting up the internal parts of such stables, the main objects are those of convenience, the safety of the animals, the prevention of the waste of food, and economy in the labour of those who have the providing, preparing, and giving of it, as well as the management of the animals, in such cases.

Some have advised the having short distinct stalls in stables, so that each horse may consume his feeds in a separate manner, and be harnessed and prepared for work with more facility and readiness; and that the partitions, in such cases, should not be carried quite up to the ceilings of the stables, in order that a more free and open circulation of air may be produced and preserved. Others, again, contend for quite open shed-stables, where the racks and mangers are fixed low down near the ground; the horses having small yards

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for them to go into at pleasure, furnished with pumps and cisterns, as in these. With this sort of management they are supposed to do better, even without dressing, than in regular stables, by the ordinary management which is bestowed on them by farm-servants in such cases. These sorts of stables are said to have answered well in practice, in some instances. They are found beneficial, when with yards, in the winter feeding of the horses on dry fodder and carrots, or other similar roots; also in summer, feeding them with different sorts of green food and dry meat. It has been suggested, however, that as such cold shed-stables seldom do well for horses, those of the regular stable kind may be the most proper in general, and especially in all the more northern districts of the kingdom; though the open shed sort may sometimes be useful and advantageous in the more southern parts of the country, where the winter seasons are more mild and favourable, as well as more short in their duration. Low shed-stables, with large sliding shutter openings behind the horses, may often be cheap, proper, convenient, and useful, where soiling farm and team-horses, during the summer season, is practised to any great extent; as the animals, it is said, not only do better in them, but are much more easily managed in supplying them with the different sorts of green fodder in the most suitable and proper manner; and, at the same time, there are advantages produced in the way of raising manure. These stables should always be provided with suitable racks for the purpose; and there should be proper drains for conveying away all the liquid matters that may be produced, in such modes of feeding, into the littered yards, or other places destined for forming and containing the manure. They should likewise have proper places provided in or near them, for the reception of the new-cut green food, from which it can be readily and with facility distributed to the different animals in small suitable proportions, as it is wanted; there being large suitable openings into them, left for the purpose of receiving the carts, or other conveyances by which it may be brought to the stables. The horses are probably the best and most advantageously managed, in all such cases, when kept constantly tied up in the stalls.

In all sorts of stables, or very contiguous to them, as has been already suggested, there should always be proper places provided for the reception and securing of different sorts of harness and other articles and things of that kind in; as well as suitable well-secured and convenient places for fixing up properly contrived corn-bins in. When these stables are small, it is in general most convenient to have the corn-bins placed and put up in the rooms above them, and so contrived and constructed, as that the feeds may be regulated and drawn from a spout carried down into the stable part below, as by such contrivances, much time, labour, trouble, and occasionally food, may not unfrequently be saved, which would otherwise have been spent in going to the bins, measuring the grain or other sorts of provender from them, and securing them again. By having such sorts of contrivances duly provided in stables, many other sorts of substances and materials, as food, can be kept safely and ready prepared, beside those of corn, either in a mixed or separate state, as may be most suitable and convenient; such, for instance, as split-beans, cut-straw, bean and pea-haulm, and a great variety of other similar matters, which are of much consequence in the feeding and foddering of all sorts of horses.

On large farms, and in other situations where there is much room and convenience, it is always the best way to have such chests, bins, or other contrivances, constructed and fitted up on the most improved principles, as those of

the aerated granary or some others, which have the means of preserving the grain or other matters in a perfectly sweet and sound state. Where the former of these plans is adopted and had recourse to, the best form is probably that of somewhat the cubical, the bottom part being made, in some degree, in the manner of the common hopper, having the slider in the lower part of it so fixed and contrived, as that it may stand about eighteen or twenty inches from the floor of the place in which the bin or chest is put up; as by such means, sufficient room and convenience will be afforded for receiving and taking out the corn or other provender as it may be wanted. In all these kinds of bins or chests, the spouts for aerating the grain or other matters may with perfect ease, facility, and convenience, be formed and fixed from one side to the other of them; the external openings or air-holes being constantly well secured by gratings of iron-wire. In the spout parts of these bins, which molly project considerably below them, there are plate-iron sliders at their bottoms, which are secured by a small lock and key, where necessary. They have often also other small sliders put just above these, for the purpose of ascertaining and regulating the feeds of the horses, by which they can readily and without inconvenience be taken out as wanted for them.

The most useful and convenient machine for the use of stables, in crushing and bruising the grain and other substances which are necessary in them, is probably that constructed by Rawntree, as it takes up but little room, while it is very effective in reducing all such materials. It is found to operate well on oats, beans, peas, barley, and other kinds of grain employed as horse-food; and at the same time is capable of bruising malt for brewing.

Machines of the mill-kind are likewise sometimes beneficial in stables for the purpose of preparing particular sorts of horse-food. The turning horizontal hand-mill, invented by Mr. Wright, may probably be found a good and useful contrivance for performing the necessary business in these situations, as it occupies but a very small space, is readily managed, and sufficiently effective for the purpose.

It may also be of importance, that stables should be better lighted than what is commonly the case, as the blindness which is so frequently met with among horses, has lately been attributed, and not without considerable probability, to an excess of the stimulus of light on their coming out of dark or dusky stables, where the irritability of the organs of sight has been for some length of time accumulating, into the full and broad glare of day-light.

As farm-stables are mostly, during the summer months, very generally much exposed to the full open air, the doors, wickets, or windows of them being very seldom shut, except at night, and then but very rarely; the consequence of such full exposure is, that flies, which are attracted by the horse-dung and other similar matters, have very free access into them; but as it may commonly be observed, that in such exposed stables, too, the spider is very prevalent, as is seen by the number of cobwebs which are present; it may, of course, be unwise and improper to disturb or destroy them, as the insect should probably be cherished in such stables, as it may save the horse from the irritation of a variety of little troublesome enemies and disturbers. The provision of such an insect is natural, and the useful consequences of it should not be disregarded by the farmer in such stables.

In concluding the account of stables, it may be just noticed, that the manner of treating and managing saddle and light carriage-horses in them is often very negligent, uneconomical, and improper, as the different kinds of food
which

which are made use of are not unfrequently given to them in very ineligible states and modes, equally as to time, manner, preparation, and quantity; the natural habits or methods of feeding in the animals being scarcely at any time, or in any cases or circumstances, if they be ever at all attended to or regarded, so as to lead to better practices. The stuffing the racks of horses in stables at all times and seasons with large quantities of hay and other similar sorts of fodder, as is too commonly the case, is, in all circumstances and cases, a wasteful and highly improper manner of proceeding in stable-foddering. And the letting them have their feeds of corn or other sorts of provender in irregular manners and quantities, is not less detrimental and inconvenient to the animals, than stuffing them so much with hay. They never succeed well when there is much irregularity in the practices of feeding them. All the other operations about them should also be performed, as much as possible, in exact manners, and at proper periods.

But with the farm and heavy team-horses, both in the stables and on the roads, as well as in other places, the manner of treatment is still more exceptionable and improper in a variety of different districts and situations of this country. It has been observed by Mr. Vancouver, that, except in Ireland, where the method of treating farm-horses is extremely bad indeed, those in the county of Devon have perhaps as hard a measure of neglect and ill-usage dealt out to them, as is any where to be met with in the whole united kingdom. From the injudicious manner in which they receive the corn that is occasionally given them, it is supposed, in some measure, a questionable point, whether it affords them a benefit, or, by diverting their appetites from the hay, pea-haulm, or other sorts of straw, absolutely produces an injury and disadvantage, in consequence of the avidity with which they swallow the corn in an un-masticated or unchewed state. In order to rectify and remedy such improper modes of management in the stable and other treatment of farm and heavy team-horses, a better and more desirable example, it is thought, can no where be found, than that which may be drawn from the management of farm and waggon-horses in Pennsylvania and Maryland, in North America. These horses, it is said, perform journeys of two and three hundred miles over the stupendous mountains of that country, with prodigious loads of wheat and flour from the interior, and wet and dry goods from the sea-ports to the different points of embarkation, at Fort Pitt, Red-stone, Charlestown, Wheeling, and other places on the Ohio river. Notwithstanding which, these waggon-horses, through the whole extent of that country, are, it is asserted, seldom seen in a less high condition than the brewers' and other large cart-horses in the metropolis of this country. The manner in which these American horses are sustained and supported, so as to perform these labours, is, it is said, generally by feeding them, in the stables and on the roads, with hay and straw chopped in short pieces about half an inch in length, with which is mixed about half a peck of rye, oat, and Indian corn-meal, to about two and a half or three pecks of hay chopped in the same manner. A feeding-trough, sufficiently large for four or five horses to eat out of at the same time, is attached to each waggon, it is said, while on the road. The chaff is put into this trough, and after being well mixed with the given quantity of meal, is moistened, and again well stirred together, until every shred or part of the hay or chopped straw is found to be covered, or, as it were, frosted over by the meal. The avidity with which the horses eat their meat or provender, when thus prepared, may, it is supposed, be readily conceived. Their feed or meal being finished, they either

pursue their journey or lie down to rest; but in either case, it is observed, not without being well dressed, and perfectly freed and cleansed from the muddy and other effects of their last labour. It is the pride and pleasure, it is said, of the carters, as well as of the waggon masters in that country, to see their horses in a condition rather above than under the labour which they have to perform; and in a hundred miles travelling, from Baltimore to Philadelphia, it is confidently asserted, that as many prime waggon-horses, and in as high condition, may be seen, as is the case in any direction for the same distance from the chief city of this country. The adoption of a similar manner of treatment in the management of farm and waggon-horses in the stables and on the roads in this country, needs, it is thought, no further recommendation than the certainty of these facts and statements, which are unquestionable.

The practice of baiting post, stage, and travelling horses with rye, oat, or bean-bread, in the manner performed on the continent, is likewise, it is supposed, an infinitely more economical and facile mode of administering refreshment to jaded, exhausted, and labour worn-out animals, than that of giving them the crude corn in its unbroken state, which is so commonly and indeed almost universally practised in this country.

That there are great waste, want of economy, and loss of nourishment, in the too general practice of giving unbroken corn to animals, especially horses, is extremely evident, from the state it is in after it has passed through their bodies, as it is found, in many cases of horses thus fed, to have lost but a little of its nutrient property, being still capable of supporting other sorts of animals, particularly those of the granivorous kinds, in a perfect manner. In its unbroken condition, when not completely masticated or broken by the teeth of the animals, as is frequently the case, the digestive process of the stomach would seem to have but little effect upon it, as it passes in nearly its natural state, while, when broken or crushed by art, it readily acts upon it, and the whole of its nourishing property is taken up there, and in its long course through the bowels, in consequence of its being so much more fully and extensively applied to their surfaces. All horses are, therefore, far better fed and supported, where the grain is reduced in its preparation before it is given, than in the common usual modes of giving it whole. The supposed defect from want of chewing and mixing the saliva of the mouth with it, where broken grain is given as the feeds of the animals, is probably complete supposition, being founded on an imperfect consideration of the matter, and not upon the result of actual trials, as it has been a great deal talked about without any sort of proof, which can be depended on, being given in its support.

STABLE Bin or Hopper, that sort of box, or contrivance of that kind, which is fixed up in stables for the purpose and convenience of containing the corn or other sort of provender, which is to be given to horses in such places.

STABLE Logger, Lump, or Ball, the oval, oblong, or round piece of solid wood, which has a hole through its middle, for the purpose of receiving and passing the rein of the horse's head-stall or halter through, and fastening it by a knot or otherwise, after it has been put through a ring fixed to the manger or other part of the stall, in order to poise and keep it tight, but not to be so heavy as to inconvenience the horse in feeding or otherwise. There are often in good stables, two reins to each head-stall balanced in this manner. The forms and weights of these pieces of wood should always be well suited and proportioned to the nature and powers of the horses.

STABLE Rings for Stalls, the strong iron rings which are fixed to the mangers or sides of the stalls of stables for the purpose of the halter or head-stall reins of the horses running in. There are not unfrequently two to each stall in well fitted up stables, but common stables have seldom more than one. These rings are mostly of the common kind, made so as to work in a shank, which screws into the part of the stall to which the rings are to be fixed; but a great improvement has lately been made in them, by having them formed in somewhat the manner of and as a strong spring, by which, in case of the horse becoming entangled in the reins, accidents may be prevented by their giving way. At all other times they are as perfectly safe as the common ring. In these cases, they have also a screw-shank, in order to be fixed in their proper places, but are not moveable in it, as in the common ring.

STABLES'S STRAIT, in *Geography*, a channel between Sugar-loaf island and Banker's island, in the Mergui Archipelago.

STABLESTAND, in the *Forest-law*, is when a person is found at his stand in the forest, with a cross-bow or long-bow, ready to shoot at a deer, or else standing close by a tree with greyhounds ready to slip.

This is one of the four evidences, or presumptions, by which a man is convicted of intending to steal the king's deer; the other three being back-berond, bloody-hand, and dog-draw. See **FOREST**.

STABLO, or **STAVELO**, in *Geography*, a town of France, in the department of the Ourte, and chief place of a canton, in the district of Malmedy, situated on the river Rechte, and deriving its name from that of an ancient abbey, founded in the year 657 by Sigebert, king of Austrasia, for the accommodation of St. Remacle, bishop of Maestricht, who preferring solitude to the episcopal dignity, retired hither, and became the first abbot. The place contains 2604, and the canton 7903 inhabitants, on a territory of 292½ kilometres, in 10 communes. The manufacture and trade, which are considerable, consist of cloth and stuffs, and the tanning of leather; 20 miles S. of Aix-la-Chapelle.

STACCATO, Ital. is a term in *Musick*, which implies a distinct separation of one note from another, in a plain and articulate manner. The term is confined to instrumental music, and chiefly to that of the violin kind, where the stroke of the bow is to be given to every note, and none of the passages are to be slurred; that is, no two or more notes are to be played with the same bow.

STACHYS, in *Botany, from *σταχυς*, a spike, because the flowers, though whorled, are more crowded into a spiked form than most others of the same natural order; which may, in some measure, answer Ray's objection to this ancient name, as not peculiarly apposite.—Linn. Gen. 293. Schreb. 390. Willd. Sp. Pl. v. 3. 97. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 632. Prodr. Fl. Græc. Sibth. v. 1. 407. Ait. Hort. Kew. v. 3. 397. Pursh v. 2. 407. Juss. 114. Tourn. t. 86. Lamarck Dict. v. 7. 364. Illustr. t. 509.—Class and order, *Didynamia Gymnospermia*. Nat. Ord. *Verticillata*, Linn. *Labiata*, Juss.*

Gen. Ch. *Cal.* Perianth inferior, of one leaf, tubular, angular, permanent, cut about half way down into five awl-shaped, pointed, awned, rather unequal, teeth. *Cor.* of one petal, ringent; tube very short; throat oblong, gibbous downwards at the base; upper lip erect, nearly ovate, vaulted, often emarginate: lower larger, reflexed at the sides, three-cleft; its middle segment very large, emarginate, folded backward. *Stam.* Filaments four, two of them shorter than the rest, all awl-shaped, curved towards

each margin of the throat after flowering; anthers simple. *Pist.* Germen superior, four-lobed; style thread-shaped parallel to the filaments, and as long; stigma in two acute divisions. *Peric.* none, except the scarcely altered calyx. *Seeds* four, ovate, angular.

Eff. Ch. Calyx five-cleft, awned. Upper lip of the corolla vaulted: lower reflexed at the sides; its middle segment largest, emarginate. Fading filaments reflexed towards the sides.

Stachys is chiefly an European genus, of herbaceous, or somewhat shrubby, mostly perennial, plants. Loureiro indeed has a *S. Artemisia*, found in China and CochinChina; but we cannot, from his account, be certain as to its genus. Mr. Pursh enumerates four American species, three of which are new. The fourteenth edition of Linn. Syst. Veg. contains seventeen, Willdenow has twenty-six. We shall particularize some of the most remarkable, especially the five British species, and a new one from Crete.

S. sylvatica. Hedge Woundwort! Linn. Sp. Pl. 811. Willd. n. 1. Fl. Brit. n. 1. Engl. Bot. t. 416. Curt. Lond. fasc. 3. Riv. Monop. Irr. t. 26. f. 2. t. 34. (*Galeopsis vera*; Ger. Em. 704.)—Whorls of six flowers. Stem solid. Leaves heart-shaped, stalked.—Native of hedges and shady situations, throughout Europe, frequent with us, flowering in July and August. The root is somewhat creeping, perennial, not annual. Herb erect, two or three feet high, of a dark green, covered with fine, rather glittering hairs, and exhaling a pungent, disagreeable, very peculiar scent. Stem solid. Leaves broad. Spike interrupted, leafy at the bottom, bracted above. Calyx hispid. Corolla of a deep dull blood-red, elegantly variegated in front with purple and white.

S. ambigua. Ambiguous Woundwort. Engl. Bot. t. 2089. Ait. n. 5.—Whorls of six flowers. Stem hollow. Leaves oblong, heart-shaped at the base, stalked.—Found in the Orkneys, very abundantly, in potatoe-fields and other cultivated ground, as well as in the north of Scotland, and near the Pentland hills, flowering in August and September. It seems intermediate between *S. sylvatica* and *palustris*, some specimens more resembling the former, others the latter. The root is white and creeping. Stem hollow, its hairs more or less deflexed. Lip of the corolla less strikingly variegated. The stalked leaves distinguish this species from *S. palustris*; while their narrower oblong form, more silky surface, and the want of any very strong setor, render it unlike the *sylvatica*.

S. palustris. Marsh Woundwort. Linn. Sp. Pl. 811. Willd. n. 4. Fl. Brit. n. 2. Engl. Bot. t. 1675. Curt. Lond. fasc. 3. t. 35. Riv. Monop. Irr. t. 26. f. 1. (*Panax Coloni*; Ger. Em. 1005.)—Whorls of six flowers. Leaves linear-lanceolate, half embracing the stem.—Found in marshy watery places, about the banks of rivers, throughout Europe; common in England, flowering in August, and very troublesome in low, wet cultivated fields. The root is fleshy and tuberous, creeping extensively, and very difficult of extirpation. Stems erect, two or three feet high, strongly quadrangular, rough, with deflexed bristles. Leaves sessile, ferrated; silky above; rather woolly beneath. Spike of many leafy whorls. Corolla light purple; its lower lip streaked with white and violet. The herb is fetid. Gerard calls it Clown's Woundwort, because he was instructed by a clown to use it as a vulnerary, with so much success, that, according to his account, it might supersede all other surgical applications!

S. germanica. Downy Woundwort. Linn. Sp. Pl. 812. Willd. n. 6. Fl. Brit. n. 3. Engl. Bot. t. 829. Fl. Dan. t. 684. Jacq. Austr. t. 319. (S. Fuchii; Ger. Em. 695.

S. montana; Riv. Monop. Irr. t. 27. f. 1.)—Whorls of many flowers. Leaves crenate. Stem woolly, erect.—Native of Germany, Siberia, France, England, and Greece. With us it is rare, occurring only on some chalky or limestone soils, flowering in July. The stems are densely clothed with soft white wool. Leaves stalked, ovate, acute, covered with soft white pubescence, most woolly beneath. Flowers numerous, silky and silvery at the outside; purple and white in front.

S. lanata Woolly Woundwort. Murray in Linn. Syst. Veg. ed. 14. 536. Jacq. Misc. v. 2. 342. Ic. Rar. t. 107. Willd. n. 8. Ait. n. 9.—Whorls of many flowers. Leaves woolly. Stems procumbent and rooting at the base.—Native of Siberia. Frequent in gardens, where it proves a hardy perennial, flowering throughout the summer, and forming large tufts, conspicuous for their very white woolly appearance. The leaves are more obtuse, and far more densely woolly, than in the last. Dr. Sibthorp's manuscripts inform us that the present species is called *σαχυσ*; by the modern Greeks in Laconia.

S. coccinea. Scarlet Chili Woundwort. Willd. n. 3. Ait. n. 3. Jacq. Hort. Schoenbr. v. 3. 18. t. 284. Curt. Mag. t. 666.—Whorls of six flowers. Leaves ovate, crenate, hairy; heart-shaped at the base, with dilated footstalks.—Native of South America. Said to have been brought from Spain in 1798, by the late marchioness of Bute. This is a hardy greenhouse plant, readily increased by cuttings, or by parting its roots, and producing abundance of large flowers, of that rich scarlet hue so prevalent in the vegetable productions of Chili and Peru.

S. hyssopifolia. Hyssop-leaved Woundwort. Michaux Boreal-Amer. v. 2. 4. Pursh n. 1. (*S. palustris*? Walt. Carol. 162.)—"Whorls of about four flowers. Stem erect. Leaves sessile, linear-lanceolate, slightly toothed, nearly smooth."—Native of Carolina. A slender, upright, nearly smooth plant, with about four flowers in each whorl. Michaux.

S. aspera. Harsh Woundwort. Michaux Boreal-Amer. v. 2. 5. Pursh n. 2. (*S. tenuifolia*; Willd. n. 11. *S. arvensis*? Walt. Carol. 162.)—"Whorls of about six flowers. Stem erect, very rough, with deflexed bristles. Leaves lanceolate, acute, serrated, very smooth. Teeth of the calyx spinous, divaricated.—In low fields and on the banks of rivers, from New York to Virginia, flowering from June to August. It resembles *S. palustris*. Root perennial. Flowers purple. Pursh.

S. hispida. Britly Woundwort. Pursh n. 3. (*S. foliis lanceolatis*, &c.; Gron. Virg. ed. 2. 89, but not the plant of Linnæus, nor of any other author cited, except Clayton, n. 271.)—"Whorls of about six flowers. Stem bristly. Leaves stalked, ovate-oblong, bluntly serrated, bristly. Calyx smoothish."—In old fields and low pastures, from Virginia to Carolina, flowering in July. Flowers purple. Gronovius's synonym has been erroneously referred to *S. annua*, from which his original specimen proves widely different. Pursh.

S. Faniculum. Fennel-scented Woundwort. Pursh n. 4.—"Whorls of about six flowers. Stem erect, downy. Leaves ovate, somewhat heart-shaped, toothed; smooth above; whitish and downy beneath."—On the banks of the Missouri; annual, flowering in July. Flowers blue. The whole plant smells extremely like Fennel. Pursh.

S. spinosa. Thorny Woundwort, Asses' Thyme. Linn. Sp. Pl. 813. Willd. n. 13. Ait. n. 12. Sm. Fl. Græc. Sibth. t. 559, unpublished. (Gaidarothimo di Candia; Pon. Bald. 106.)—Hoary. Branches crossing each other, tipped with spines. Flowers axillary, ternate.—Native of Crete,

where most botanical travellers have gathered this species, and from whence it came into the gardens of Parkinson and other curious cultivators of that time, though now scarcely to be met with. The plant is bushy, of humble growth, spinous, pale green, with small leaves. Flowers white, their lip prettily spotted with red.

S. palestina. Greek Woundwort. Linn. Sp. Pl. 1674. Willd. n. 15. Prodr. Fl. Græc. n. 1363. (*S. alba*, angusto salvia folio; Barrel. Ic. t. 279.)—Whorls of about six flowers, crowded, leafy. Leaves sessile, lanceolate, entire, veiny, finely downy; as well as the nearly round stem.—Native of the Levant. Dr. Sibthorp found it plentiful throughout Greece, in rough and stony mountainous places, as Dioscorides mentions of his *σαχυσ*, and therefore concludes it to be that identical species. It answers, indeed, well enough to the description. The stems are erect, bushy, somewhat shrubby, leafy, nearly round, clothed with peculiarly fine, close, dense, woolly hoariness. Leaves an inch and half or two inches long, scarcely one-third of an inch broad, very soft and downy on both sides; the floral ones short and ovate. Calyx unarmed, downy, like the outside of the corolla, whose lips are purple, the throat variegated with white.

S. rugosa. Rugged Yellow Woundwort. Ait. ed. 1. v. 2. 303. ed. 2. n. 17. Willd. n. 20. Jacq. Ic. Rar. t. 493.—Whorls of six flowers. Leaves lanceolate, serrated, rugose, downy; tapering at the base, and somewhat stalked. Stem round, finely downy.—Native of the Cape of Good Hope, from whence Mr. Maffon is said to have introduced it in 1774, yet Thunberg has it not in his Prodrömus. The stem is shrubby, bushy, quite round, very white, as in the last, to which the leaves also bear a great resemblance, but are more stalked. Jacquin's plate shews no serratures. The flowers are axillary, with a white tube and yellow lips.

S. annua. Pale Annual Woundwort. Linn. Sp. Pl. 813. Willd. n. 23. Ait. n. 19. Jacq. Austr. t. 360. (*Sideritis flore albo*, barbâ luteolâ; Riv. Monop. Irr. t. 70. *S. latifolia glabra*; Ger. Em. 699.)—Whorls of six flowers. Leaves ovate-lanceolate, serrated, stalked, smooth, three-ribbed. Stem branched, erect.—Native of Germany and the south of Europe. Kept sometimes in curious gardens, rather for curiosity than any valuable property. The root is annual. Stem erect, square, with opposite spreading branches. Leaves green; the larger ones stalked; uppermost narrower, and sessile. Calyx-teeth spinous. Corolla white, with a yellowish lip.

S. arvensis. Corn Woundwort. Linn. Sp. Pl. 814. Willd. n. 24. Fl. Brit. n. 4. Engl. Bot. t. 1154. Curt. Lond. fasc. 4. t. 41. Fl. Dan. t. 587. (*S. arvensis minima*; Riv. Monop. Irr. t. 27. f. 2.)—Whorls of six flowers. Stem weak, spreading. Leaves heart-shaped, obtuse, crenate, rather hairy.—Common in the fields of Britain, and other parts of Europe, especially where the soil is light and sandy, flowering in July and August. Root annual, small. Stems spreading, often prostrate, a span long, square, hairy or smooth. Leaves stalked, ovate, fetid, an inch long. Flowers small, light purple, with a white and dotted palate; their calyx hairy, with violet teeth.

S. spinulosa. Prickly-branched Woundwort. Prodr. Fl. Græc. n. 1368. (*S. foliis hormini*; Riv. Suppl. t. 15. *Sideritis cretica maxima*, ocymastri valentini facie; Tourn. Cor. 12.)—Whorls of six flowers. Leaves heart-shaped, crenate, hairy. Stem erect, branched, minutely prickly.—Native of Crete, where Dr. Sibthorp found it. Arduino sent a specimen to Linnæus, marked with Tournefort's synonym; and we have lately noticed a figure of this plant, in the rare unpublished supplement to Rivinus, of which the only copy known to exist, apparently once belonging to the

the author, is in sir Joseph Banks's library. The *root* is fibrous, probably annual. *Stem* a foot or foot and half high, erect, branched, square, with prickly angles. *Leaves* stalked, an inch and half long, bluish, ribbed and veiny, green, more or less hairy. *Whorls* leafy, rather crowded. *Calyx* bell-shaped, hairy, with short spinous teeth. *Corolla* yellowish, twice as long as the calyx; its upper lip entire.

STACHYTARPHETA, from *σάχυν*, a *spike*, and *ταρῆν*, *dense*, a name of Vahl's, intended to express the close uninterrupted disposition of the flowers.—Vahl Enum. v. 1. 205. Juss. Annal du Mus. v. 7. 75 Ait. Hort. Kew. v. 1. 46.—Class and order, *Diandria Monogynia*. Nat. Ord. *Verbenaceae*, Juss. Brown.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, tubular, angular, with four acute teeth, permanent. *Cor.* of one petal, salver-shaped; tube cylindrical, longer than the calyx, somewhat recurved at the upper part; limb spreading, divided half way down into five roundish unequal segments, the lowest being the smallest. *Stam.* Filaments four, inserted into the upper part of the tube, not reaching to its top, two of them imperfect; anthers of two cells, one over the other. *Pist.* Germen superior, two-lobed; style the length of the tube, capillary; stigma peltate. *Seeds* two, linear, the length of the calyx.

Ess. Ch. Calyx tubular, with four teeth. Corolla salver-shaped, unequal, five-cleft, curved. Two abortive stamens. Seeds two.

A handsome and distinct genus, of tropical, chiefly West Indian, annual or shrubby plants, previously confounded with *Verbena*. Their *branches* are obscurely quadrangular, divided in a forked manner in the upper part. *Leaves* opposite, stalked, tapering down into the footstalks. *Spikes* from the forks and summits of the branches, solitary, elongated, cylindrical, tapering, acute. *Flowers* alternate. *Bractees* tapering into a bristly point. *Calyx* as long as its corresponding channel in the common stalk.

Twelve species are defined by Vahl.

1. *S. angustifolia*. Narrow-leaved Bastard Vervain. Vahl n. 1, excluding Jacquin's synonym. (*Verbena angustifolia*; Mill. Dict. ed. 8. n. 15.)—"Leaves lanceolate, tapering at each end, distantly serrated, smooth."—"Gathered at Vera Cruz, by Houlbourn, who sent seeds to Miller. The latter describes it as an annual branching plant, a foot and half high. *Leaves* pale green, acute, three inches and a half long, half an inch broad. *Spikes* fleshy. *Flowers* blue, appearing in August, and in warm seasons ripening seed in our gardens.—We agree with Vahl that Miller's plant, though we have not seen it, is probably distinct; but Jacquin's *indica* surely is the following.

2. *S. indica*. Indian Bastard Vervain. Vahl n. 2. Ait. n. 1. (*Verbena indica*; Linn. Sp. Pl. 27. Jacq. Obs. fasc. 4. 7. t. 86.)—"Leaves lanceolate-oblong, tapering at the base, coarsely toothed, smooth as well as the stem. *Bractees* linear-lanceolate.—Native of Ceylon. Van Royen sent seeds to Linnæus, who raised the plant in his stove. It is annual, flowering in August and September. The *leaves* are an inch or more in breadth; the lower ones obtuse. *Spikes* long and slender. *Bractees* finely striated, membranous at the edges. *Corolla* blue. Jacquin represents the *leaves* more narrow and acute, with more regular serratures, than in the Linnæan specimen, which came from the Upsal garden, and is accompanied by a branch with narrower leaves. This latter, evidently a mere variety, may be similar to what Vahl had from the same garden, and took for Miller's *Verbena angustifolia*.

3. *S. aristata*. Awned Bastard Vervain. Vahl n. 3. (*Verbena aristata*; Vahl Ecl. Amer. v. 2. 2. t. 11.)—

"Leaves oblong, serrated, acute; villous and slightly hoary beneath. *Bractees* ovate, pointed. Stem shrubby."—Gathered by Von Rohr in South America. *Branches* purplish-grey. *Leaves* an inch and a half long, tapering at each end, equally and deeply serrated, entire at the base, ribbed; the ribs most hoary underneath. *Spike* sometimes near a foot long. Lower *bractees* spreading; upper imbricated, somewhat fringed, longer than the *calyx*. Vahl.

4. *S. jamaicensis*. Jamaica Bastard Vervain. Vahl n. 4. Ait. n. 2. (*Verbena jamaicensis*; Linn. Sp. Pl. 27. Jacq. Obs. fasc. 4. 6. t. 85. V. folio subrotundo ferrato, flore cæruleo; Sloane Jam. 171. t. 107. f. 1. *Cymburus urticifolius*; Salis. Parad. t. 53.)—"Leaves ovate, obtuse, serrated, nearly smooth. *Branches* hairy. *Bractees* ovate, shorter than the calyx.—Native of the West Indies. Introduced very early into our stoves. The *stem* is naturally shrubby and perennial, though it seldom survives after flowering in a hot-house. *Leaves* two inches long, tapering down into a winged *footstalk* half that length; their veins and margins roughish with short hairs. *Spikes* a span long, hardly thicker than a crow's quill. *Bractees* close-pressed. *Corolla* blue, somewhat resembling the elegant *Duranta Ellisia*.

5. *S. dichotoma*. Forked Bastard Vervain. Vahl n. 5. ("Verbena dichotoma; Fl. Peruv. v. 1. 23. t. 34.")—"Leaves oblong-ovate, serrated. *Branches* hispid. *Bractees* lanceolate, the length of the calyx."—Native of woods in Peru. *Stem* shrubby, erect, a yard high, slightly branched; the branches compressed in each joint at the upper part. *Leaves* acute, veiny, minutely hispid beneath; their serratures pointed. *Spikes* a foot long, curved. *Seeds* striated externally. *Fl. Peruv.*

6. *S. marginata*. Bordered Bastard Vervain. Vahl n. 6.—"Leaves roundish-ovate, smooth, with tooth-like serratures; the edges of the teeth cartilaginous. Stem shrubby."—Found by Von Rohr in the West Indies. *Branches* round, smooth, like the rest of the plant. *Leaves* an inch long, firm, very obtuse, ribbed, without veins, with pointed coarse teeth. *Spikes* six inches long, as thick as a pigeon's quill. *Bractees* linear-lanceolate, tapering, the length of the calyx, finely striated. Vahl.

7. *S. strigosa*. Strigose Bastard Vervain. Vahl n. 7.—"Leaves ovate-oblong, crenato-serrated, hairy like the branches."—Native of the West Indies. *Ventenan*. Shrubby, with round *branches*, which are besprinkled, like the *leaves* and *footstalks*, with white hairs. *Leaves* very blunt, an inch long, ribbed, veinless. *Spikes* no thicker than packthread, about four inches long. Vahl.

8. *S. cajanensis*. Cayenne Bastard Vervain. Vahl n. 8. (*Verbena cayennensis*; Richard Act. Soc. Hist. Nat. Paris. v. 1. 105.)—"Leaves ovate, crenato-serrated, smooth, very obtuse. Stem shrubby."—Native of Cayenne. *Branches* round, their young extremities hairy, as well as the *flower-stalks* and the *leaf-stalks*. *Leaves* two inches long, coarsely crenate, ribbed. *Spikes* slender, four inches in length. *Bractees* slender, hairy like the *calyx*. Vahl.

9. *S. orubica*. Orubian Bastard Vervain. Vahl n. 9. Ait. n. 3. (*Verbena orubica*; Linn. Sp. Pl. 27. Pluk. Almag. 382. t. 228. f. 4, and t. 327. f. 7. *Sherardia urticæ folio subtus incano, floribus violaceis*; Ehret. Piët. t. 5. f. 1.)—"Leaves ovate, serrated, rough and rugose. Stem shrubby. *Bractees* ovate, larger than the calyx.—Native of Panama. A greenhouse or stove shrub, early introduced, but not often met with in our collections. The *stem* is a yard high, branched. *Leaves* deeply serrated, rounded. *Spike* twelve or eighteen inches long, with squarrose *bractees*. *Corolla* violet, with a dark divided spot.

10. *S. mutabilis*. Changeable-flowered Bastard Vervain. Vahl n. 10. Ait. n. 4. Curt. Mag. t. 976. (*Verbena mutabilis*; Jacq. Coll. v. 2. 334. Ic. Rar. t. 207. Andr. Repof. t. 435. Venten. Malmaif. t. 36. *Cymburus mutabilis*; Salif. Parad. t. 49.)—Leaves ovate, ferrated, rugose, fomewhat hoary as well as the stem. Braçteas lanceolate, shorter than the calyx.—Native of South America. A ftove-plant, flowering throughout the fummer, and propagated by cuttings. This is larger and more fplendid than any of the foregoing. *Leaves* often four inches, or more, in length. *Spikes* a foot long. *Flowers* large, crimfon, with a central ring of a blood-red, round the white throat. The *corolla* fades before it goes off, occafioning a perpetual variety of hues in each fpike.

11. *S. prismatica*. Germander-leaved Bastard Vervain. Vahl n. 11. Ait. n. 5. (*Verbena prismatica*; Jacq. Coll. v. 2. 301. Ic. Rar. t. 208. *V. fpicata jamaicana*, *Teucii pratensis folio*, difpermos; Pluk. Alm. 382. t. 321. f. 1.)—Leaves ovate, obtufe, ferrated. *Spikes* lax. Braçteas awl-shaped, fhorter than the calyx.—Native of the Welt Indies. Biennial in our hot-houfes, flowering in May and June. The *ftem* has many fmoth, fender, forked branches. *Leaves* one or two inches long, green, roughifh, ribbed. *Flowers* fewer and more difperfed than in the reft, of a violet blue, fmall and rather inconfpicuous.

12. *S. Squamoſa*. Scaly Bastard Vervain. Vahl n. 12. (*Verbena Squamoſa*; Jacq. Hort. Schoenbr. v. 1. 3. t. 5.)—Leaves elliptic-lanceolate, alternate, with fhallow wavy ferratures. Flower-ftalks axillary, fcaly, much longer than the leaves. Stem fhubby. Corolla ringent.—This flowered in the imperial ftoves at Schoenbrun, but its native country is unknown. We fhould preſume the plant to be of South America origin. The *branches* are villous. *Leaves* dark green, fpreading, three inches long. *Flower-ftalks* very peculiar, numerous, from five to ten inches long, hairy, thread-shaped, fometimes branched, covered entirely with innumerable clofe braçteas. *Flowers* very fmall, pale blue; their upper lip erect, fhort, cloven; lower larger, fpreading, in three cloven fegments. Vahl has doubts reſpecting the genus of this plant, its leaves being alternate. We fufpect it to be more allied to *Juſſicia*; at leaft to the Linnæan *J. acaulis*, which is Vahl's *Elytraria erenata*.

STACK, NORTH, in *Geography*, a cape on the W. coaft of the ifland of Angleſea; 2 miles N. of Holyhead.

STACK, in *Agriculture*, a quantity of corn, pulſe, hay, ſtraw, stubble, or other fimilar material, regularly built or piled up, and generally thatched, as a defence from the weather. Stacks are of various forms and dimenſions, according to circumſtances; but for grain, thoſe of the long, narrow, ſquare ſhape are probably the moſt advantageous, where the quantity of corn is conſiderable; as they are found to ſtand more firmly, have a better appearance, are more conveniently and readily built, and preſerve the grain better than thoſe of other forms. And they have the great advantage of requiring leſs thatch, as well as labour in putting it upon them. But where the corn is only in a ſmall proportion, the round or oblong ſhape may be more proper and fuitable, as being more readily drawn up in the roof; and the circular, with a conical top and cylindrical body diverging a little at the eaves, is eſteemed the beſt form of any in ſuch caſes by the author of the *Agricultural Report* of Perthſhire. For hay, the form of the ſtack is a matter of ſtill leſs conſequence: the long ſquare or oblong ſhapes are perhaps the moſt ſafe and convenient, eſpecially when not too broad, as they admit the air the moſt fully. Befides, they are the moſt convenient to cut from in truſſing hay for ſale at the market. But the circular form for farm

ufe, where ſtraw is ſcarce, may be more advantageous in ſaving ſtraw in thatching or covering them.

The octagonal form of corn-ftack has ſometimes a pleafing and very ornamental effect in particular circumſtances and ſituations, eſpecially in the ſtack-yards of the farms about country ſeats and refidences, but it requires more time and trouble in building and finiſhing than thoſe of moſt other ſhapes, conſequently is improper, in general, except in ſuch places, circumſtances, and ſituations.

The oblong and long ſquare forms of corn-ftacks, with circular ends in the latter caſe, are ſometimes very convenient, uſeful and advantageous, as they are built and finiſhed in a ready and eaſy manner, take up but little room in comparison with ſome other forms, and keep the grain remarkably well and ſafe. In building them, the different courſes of the ſheaves, which are not many in the width, are laid ſo as to bind on each other and ſecure the whole, as will be ſeen in ſpeaking of ſtacking grain in a more full and clear manner.

In the ordinary circular form of corn-ftack, the thatch, which ſhould always come down to the termination of the moſt bellying-out or ſpreading-out part of the ſtem, is uſually ſecured and kept on in the common way, without the uſe of any ſort of rope or other contrivance of that kind. Ropes are, however, ſometimes employed.

But there is another form of corn-ftack, which is common in the northern parts of this country and that of Scotland, which is of the round kind, and which moſtly reſts on a wooden frame upon high ſtone ſupports with flat caps. The ſtem is made perfectly upright to the eaves, where the ſheaves of the upper part are made to project ſome way at fiſt, and then gradually taken into a point at the top. The thatch or covering in this caſe, in conſequence of the windy and ſtormy ſituations in which the ſtacks are moſtly expoſed, are, for the moſt part, ſecured by means of ſtraw-ropes, or thoſe of other kinds, put on in a ſort of checquered manner, one rope being made to croſs or paſs over the other, ſo as to afford ſomething of this appearance. There are two ſtraight ropes, to which all the others, which are oblique, are faſtened, the ends being well ſecured by being paſſed round a ſtrong belt-rope which ſurrounds the top of the upright ſtem of the ſtack. The different oblique ropes are put on alternately from the different ſides of the ſtack. In ſome caſes, the ends of the oblique ropes are fixed to the butt-parts of the ſheaves, without any ſort of belt-rope being employed. See *THATCHING of Grain-Stacks*.

There are a few other forms of corn-ftacks, which are occasionally made uſe of in particular circumſtances and caſes of farms; but more for the ſake of curioſity, than any utility they may have in practice.

In ſtacks with any ſort of pulſe crops, as peas, beans, feeding tares, and other ſimilar matters, the ſame forms may be moſtly had recourſe to, but their ſtem-parts need ſeldom be ſo much bellied out at the eaves as in corn-ftacks, as there is moſtly leſs danger from wet; they ſhould always, however, have ſo much outward diverging at the tops of the ſtems, as fully to carry off the water from them. The ſtalk or butt-ends of all ſuch ſorts of produce, when put into ſtacks, ſhould conſtantly be carefully laid in an outward direction, ſo that as few of the pods as poſſible may be expoſed to the moiſture of the air. The top-parts in ſtacks of this kind have rarely any occaſion to be carried up to ſo much height, as is the caſe ſometimes in corn-ftacks. Theſe ſorts of ſtacks, as well as thoſe of corn, ſhould always be put on ſtands or ſtaddles which are conſiderably raiſed from the ground.

In the forms of hay-ftacks there is leſs variety than in thoſe

those of corn, but they have some degree of variety according to circumstances, and the nature of the situations in which they are placed, as well as some other causes. The most useful forms are probably those of the square, long square, oblong, and perfectly round kinds. There is a curious sort of low very bellying form, which rests on a very small basis or saddle at bottom, and which has an equally low top, which is sometimes in use. This is somewhat the form or shape of a sort of hay-stack, which in Scotland, and some of the more northern English districts, is often denominated a hay-sow.

In stacks with hay of the artificial grass kinds, as that of clover, saintfoin, tares, and other similar sorts, the stacks should never be made so large as in the case of natural grass-hay, as such sorts of hay, in order to secure them in the best manner, should never be so much or so well made as that of the natural grass kind, consequently never be put together in stacks in such large quantities, as there may often be danger, inconvenience, and loss in such practices.

In stacks of the straw and stubble kinds, very little more is seldom necessary than merely the securing of the materials; they need but rarely have so much labour and time bestowed upon forming the top-parts of them, as is often the case in corn and hay-stacks, as the matters scarcely ever remain in them for any great length of time, being mostly in a state of gradual removal for different uses.

It may be farther observed, in respect to the sizes of stacks of the first sort, that they of course vary greatly according to circumstances; but they should never be made too large, as there is a great deal more labour and risk in securing and getting in the grain for them, than in those of a smaller size; and from their being built at different times, they do not settle altogether in so equal and perfect a manner, or resist the effects of the weather, and keep the grain so well, as those of less dimensions, that can be completed at once: and, in addition, they are more convenient in the threshing out, especially where the flail manner is employed. The chief advantages they possess are those of taking something less in thatch and labour in covering them, as has been just noticed. But, in common, from about twenty to thirty-two horse cart-loads may be sufficient for one stack, on all the middling-sized farms in most of the grain districts of this kingdom.

And in regard to the proper size of the hay-stack, it should probably be different in some degree, according to the state and nature of the hay; but a middling size is perhaps the best, as from twenty to thirty loads of about one ton each; as there are inconveniencies in both small and large stacks, the former having too much outside, while the latter are liable to take on too much heat, and at the same time permit less moisture to be preserved in the hay. In small stacks, the bellying forms, with very narrow bottoms, have often much advantage, and are in some districts termed sheep-stacks, probably from the slovenly practice of sheep having been permitted to feed at them. It is observed by Mr. Middleton, in his Agricultural Survey of Middlesex, that there are no hay-stacks more neatly formed nor better secured than those of that county. At every vacant time, while the stack is carrying up, the men are employed in pulling it with their hands into a proper shape; and about a week after it is finished, the whole roof is properly thatched, and then secured from receiving any damage from the wind, by means of a straw-rope extending along the eaves, up the ends, and near the ridge. The ends of the thatch are afterwards cut evenly below the eaves of the stack, just of sufficient length for the rain-water to drip quite clear of the hay. When the stack happens to be

placed in a situation which may be suspected of being too damp in the winter, a trench of about six or eight inches deep is dug round, and nearly close to it, which serves to convey all the water from the spot, and renders it perfectly dry and secure.

It may be noticed, that in stacks of all kinds, proper stands or saddles should constantly be provided, being well proportioned to the intended size of the stacks. Those for grain should have copings placed so as to prevent the entrance of vermin: but for hay there is no necessity for this, nor need they be raised so high, but be quite plumb and upright. It is evident, that by the common method of placing them upon the ground, on a little drift, or a few pieces of wood laid across each other, there must constantly be great loss in the bottom parts of the stacks, from the moisture being absorbed by the hay, and it becoming in a rusty condition; while by the use of stands, this may be almost wholly avoided, and the expence be but trifling, as any old rough pieces of wood, or other materials, will answer the purpose in a pretty perfect manner, when other better sorts of saddles are not at hand, or to be procured. See STADDLE and STAND.

All sorts of stacks should be carefully attended to, while they are forming and getting up, and never be left for any length of time, as is too frequently the case, without being properly topped up; as injury and loss are always to be apprehended wherever that is the case. Every kind of stack should likewise constantly be suffered to have completely settled in all its different parts, before it be attempted to be covered in; as otherwise the covering may be deranged and rendered unsightly, by the shrinking that may afterwards take place, and the matters be not rendered so secure or so well preserved.

Stacks of the corn kind are sometimes conveniently placed upon low frames of wood, and on low cast-iron wheels, moving in circular iron railways, contrived in such a manner as that three or four horses may, in most cases, in moderate sized stacks, draw them to the barn or threshing machine. Placing them on these sorts of contrivances is often of great utility and advantage, in saving the expence of labour and time in carting, or otherwise conveying them to such places; and is, besides, capable of being performed at any time, without waiting for the coming of fine and favourable weather for the purpose. The expence in this way of placing stacks is very trifling, and will in a great measure prevent the necessity of having capped stone standings for them. It is likewise a necessary and useful plan, in many instances, as being that alone which allows of a choice of any particular stack for threshing, without waiting for the whole or a great number of others being previously removed or taken out of the way. In some other cases the placing the stacks in straight lines, leading by and past these places, may answer the same intention, though in a much less perfect manner in different points.

STACK, *Hay-Sow*, a name given in some places to that low bowl-like bellying form of stack, which has an equally low top, secured by hay, or other similar kinds of ropes, put on in somewhat the checkered form. It is chiefly in use in such situations as are much exposed to winds and storms.

STACK, *Mow Arish* or *Errish*, that particular sort of stack or mow which is made with grain in the field, in some districts, as Cornwall, in wet and catching harvest seasons. The corn usually remains in these stacks for a fortnight or three weeks. And it is said by the writer of the corrected account of the agriculture of the above county, that these arish stacks or mows, of which he has given a representation,

ation, are admirable contrivances in such like seasons; and that if proper care be taken in forming and making of them, to keep the middle parts well up, so as that the butt-ends of the sheaves may have a considerable slope outwards, the corn will receive no damage, though it were to remain in the field a month or six weeks, or perhaps longer. See *STACKING Grain*.

STACK, Sheep Hay, a name sometimes applied to that sort of low, circular, diverging form of hay-stack, in some districts, which was formerly had recourse to about farms, for sheep to feed at during the severity of the winter season. This littering, wasteful, and slovenly mode of foddering sheep has now mostly been done away by the great value of hay, and the introduction of proper sheep-yards, with suitable contrivances for the purpose. See *SHEEP-Yard*.

STACKS, Supporting of, the practice of propping and storing them up, where they may happen to lean or incline too much to either side, so as to be in danger of falling without such aid and assistance. In those of the grain kind, it is always a good practice to arm and ease the props, or posts, which are made use of for the purpose, with a sheet of tin, nailed round them, at more than half way up, in somewhat the form of an inverted funnel, as this serves to stop vermin in their progress and attempts to get up and into the stacks; and tin, on account of its cheapness and polished surface, is found particularly well suited to the purpose.

The props or posts for this use should, in all cases, have sufficient strength, and be firmly set up to or against the stacks; having a portion of strong thick board laid to the stacks, where their upper ends come against them, to prevent their entrance into them.

This method is found to succeed well in the practice of some farmers in Gloucestershire, according to the corrected account of the agriculture of that district.

STACK-Bars, a term applied to the large bars or hurdles by which hay-stacks in fields are inclosed and secured.

The bars and hurdles for inclosing stacks should always be of a proper thickness and strength, so as not to readily give way, but resist any stress that may be brought against them by animals, in getting at the hay, or in any other way. They should also be put so near together in the fence, as to prevent any hurtful sort of animal from getting at them.

STACK-Guard, a cloth or other covering suspended over stacks, during the time of their being built, to protect them from rain, &c. It is applicable both to the securing of corn and hay-stacks, as well as those of other kinds. It is usual for this purpose to employ a large sheet of sail or other cloth, which answers perfectly, and prevents much injury and loss in wet bad seasons. In the districts of Kent and Surrey, the old or half-worn sails of ships are, according to Mr. Marshall, made use of as guards for stacks. But he thinks, that a sail-cloth, thrown over and immediately upon the hay of a stack in full heat, is liable to do more injury, by increasing the heat, and at the same time checking the ascent of the vapour or steam, than service in shooting off rain-water.

The improved method of spreading the cloth, which he observed in the district of Maidstone, in the former of the above counties, is, he says, this: Two tall poles, or fir-balks, are stepped firmly into two cart-wheels, which are laid flat upon the ground at each end of the stack, and loaded with stones to increase their firmness. Another pole of the same kind, and somewhat longer than the stack, is furnished at each end with an iron ring or hoop, large enough to admit the upright poles, and to pass freely upon them. Near the head of each of the standards is a pulley, over which a rope is passed from the ring, or end of the hori-

zontal pole, by which it is easily raised or lowered, to suit the given height of the stack. In the instance observed, the rick was begun with two loads of hay; yet even these two loads were as securely guarded from rain, until more could be got ready, as if they had been housed: for a cloth being thrown over the horizontal pole, and its lower margins loaded with weights, a complete roof is formed, and exactly fitted to the stack, whether it be high or low, wide or narrow; the eaves being always adjusted to the wall-plate, or upper part of the stem of the stack, thus effectually shooting off rain-water, while the internal moisture, or steam arising from the fermentation of the hay, escapes freely at either end, as the wind may happen to blow. And what renders this ingenious contrivance the more valuable is, its being readily put up or taken away. The poles, being light, are easily moved from stack to stack, or laid up for another season; and the wheels are as readily removed, or returned to their axles. On these hints Sir Joseph Banks seems to have made a considerable improvement, which is equally simple, cheap, and easy in the execution; and, at the same time, perfectly calculated for the purpose.

This improved apparatus, as given by a writer in the tenth volume of the *Annals of Agriculture*, is thus described. There are two long upright posts, poles, or barks of wood, which are firmly fixed and set into two wheels, somewhat in the same manner as the above; one of which is placed at each end of the stack, to which ropes and a block-tackle are so attached as to be capable of suspending the cloth or sheet over the stack in such a way as to render it readily raised or depressed at pleasure, without difficulty or much trouble; the middle part of the cloth being well prepared and secured, in order that the hooks of the tackle for regulating it may be attached to it in a suitable manner. There are three ropes on each side of each post or pole, which are fastened to rings in the upper and top parts of them, and fixed by strong large pegs down to the ground, by which means the upright posts or poles are held steady and firmly in their places. The block-tackle, by which the cloth is rendered capable of being raised or let down, as there may be occasion, consists of an upper and larger, and of a lower and smaller block, which answer the purpose very effectually. There are also four pieces, or more, of ropes, which are attached by rings to the bottom parts or edges of the cloth, on each side, by which they fix it to the ground or stack, by means of pegs driven firmly into them. The whole of the apparatus is so contrived, as to be easily and readily taken down and removed, as there may be occasion; and when not wanted, it takes up but little room in a dry secure place.

STACK Hay-Rod, the strong or stout iron rod of the bolt kind, which is forced into hay-stacks, in order to make way and form a passage for an iron gun ram-rod, which has a strong worm or screw at the lower end of it. In this way a sample of the hay is screwed and forced or taken out, and the state or condition of the stack discovered and determined. This neat and useful discovery and contrivance was made by the late Mr. Duckett, the ingenious farmer at Esler, in the county of Surrey; and the method practised by him, not only for ascertaining the state of the heat in hay-stacks, and preventing its proceeding to too great a degree, but for shewing the colour of the hay in them. When the heat is too great, it serves also for making holes in different parts and places of the stacks, in order to let it pass off, and to admit air more freely, so that the hay may be prevented from being injured in any way by it. This is an invention which, of course, may be beneficial to the hay-farmer in many different ways.

STACK-Tackle, any sort of tackle or contrivance employed about a stack of any kind, either for the purpose of assisting and expediting the work of forming, preparing, and building it, or for protecting and securing the materials of which it is composed, while the stack is forming and finishing. These different kinds of tackles and contrivances are often very necessary about stacks, while the work of forming and finishing them is in hand and going on with; as they may save much time, labour, and trouble, as well as be of great utility in preserving the different sorts of articles in a safe state from the effects of the weather, or other causes. Every kind of tackle, or contrivance of this nature, should always be made as readily applicable and convenient as possible, and so that it may perform its intended use in the easiest and most ready and complete manner there is a capability of, without having any sort of complexity or difficulty in making use of it.

STACK-Hay-Barn, that sort of open barn which is contrived for the purpose of receiving and having hay stacked up in it, in contradistinction to those of the close common kind in which it is sometimes put. These barns are constructed in several different manners, as the nature of the materials may allow, but mostly on posts of oak, or some other durable kinds, with open frames, so as to admit air in a very free manner. They have not unfrequently a capacity of holding from thirty to fifty loads of hay, and, in some instances, even so many as a hundred loads. See **HAY-BARN**.

The question has not yet been fully decided, whether hay keeps better when stacked up in the open air, or in common barns, and those formed expressly for the purpose. The opinion of most of the best hay-farmers in the southern parts of the kingdom is directly in favour of the open stack manner, so far as the quality of the hay is in any way concerned; and there can be no doubt but that the stack-barn method, described above, may be equally or more beneficial in that way, and still more advantageous in other respects. But how far the close common barn is suited to the purpose of containing hay, has probably not yet been fully shewn. However, in many of the more northern parts of the country, hay is not unfrequently secured in barns of this kind, and, on examination, has been found to be equally sweet and good as when preserved in stacks in the open air. The experimental trials of others, in the more southern districts, have likewise shewn the same thing, so far as they have gone; it being found, on cutting and binding up, that it was not less good than that from the stack-yard, being equally free from dust. It cannot, however, be disputed, that hay put up in close barns is, in general, more liable to become dusty, and of a mouldy fusty quality about the sides next the walls, and other such parts, than such as is contained in stacks in the open air, or in such barns as the above.

Many other sorts of buildings and roofed contrivances, besides those of the large stack hay-barn kind, may be had recourse to for containing hay, in different situations and circumstances, and be formed and raised in a much more ready and cheap manner.

STACK-Roofed Corn-Barn, that sort of barn which has the roof formed for the fully securing of the stacks of grain, or other such matters as may be put into it, and the sides and other parts so raised and made open, as to produce perfect security from vermin, and full ventilation of the contained materials. In the construction of it, upon the low timber platform, which is put on posts or pillars, as in stables for grain, the frame or skeleton of a perfect barn is raised, with ends, sides, and roof. The sides and ends are

left open for the full admission of air; but upon the roof is put a complete and substantial coat of thatch, or some other suitable, light, safe material, which being exposed to no injuries or mischief from mice, rats, or any thing else, excepting fire and the inclemency of the weather, will last, it is said, for upwards of thirty years.

This is considered by Mr. Howlett, in the corrected account of the state of agriculture in the county of Essex, as a very great improvement on the staddle erections for corn-stacks or ricks; for though it is remarked, that the pillars and frame in that mode, together with the care and time employed in raising and providing them, and in thatching the stacks, must obviously be attended with considerable charge beyond what would have been necessary for the mere laying up the corn in the common barn; and, after all, it must be again taken down and removed, before it can be threshed;—the height from the ground secures it from vermin; the thatch preserves it from the weather; and the exposure of its ends and sides to the air, which are merely the butt-ends of the sheaves, keeps it entirely sweet and pure, far beyond the best common barn or granary in the world. And, indeed, the farmers' ricks and barns are, it is supposed, the only kind of granaries which a wise and patriotic government in this country will ever encourage: their contents will generally be brought forth at the properest time, not stinking and spoiled by conveyance in ships from abroad, or by lying and rotting in the warehouse of the merchant, but pure, sound, and good, as when carted from the field.

The superior advantages of this stack-roofed mode over that of the common barn, and the common rick or stack manner, are, however, it is thought, great and numerous.

These sorts of barns are often made from fifty to sixty feet in length, having a breadth or width of sixteen or eighteen feet; but they may have smaller dimensions, as may be necessary. They are sometimes raised on large scales, and so contrived as to serve as cart-lodges for loaded corn, and other ways, upon the moveable rafters on the sides being taken away. See **STADDLE**, **GRAIN STAND**, and **WHEAT Rick Stand**.

STACK-Yard, the inclosure or yard in which the stacks of hay and grain, as well as those of other field produce, are placed. These yards should always be conveniently situated for the barns or threshing-mills. They should also always be sufficiently spacious and airy, having a firm dry bottom, and some advise them to be ridged up, to prevent the accumulation of surface-water; as by these being pretty well raised in the middle, and covering the places where the stacks are to be built, either with rough stones, with a mixture of gravel, or paving them in the same manner as streets, much advantage would be gained at little expence. But a much better method is to have the bottom parts for the stacks raised considerably above the surface, and placed upon pillars of wood or stone, with a covering of wood or stone round the circumference, and beams laid across. The inclosing of stack-yards is also a matter that should be attended to more particularly, and be well performed in some manner or other, either by means of low walls or palings.

On large arable farms the stack-yards are not unfrequently divided for different sorts of produce; but this is seldom or ever necessary for those of the middling or smaller sizes, as it creates an additional expence and trouble, without any adequate advantage being derived from it, especially where the yards, in these cases, are sufficiently extensive for the quantity of corn-stacks which are to be put into them.

In these yards the stacks should be arranged somewhat according to the nature of the matters or produce which are put

put into them: those which require to be kept the most dry and sweet, as the grain, pulse, and hay kinds, in the higher and more open airy parts; and those of the contrary kind in the lower and more confined parts.

Stack of Wood, among *Husbandmen*, is a pile of wood three feet long, as many broad, and twelve feet high.

STACKHOUSIA, in *Botany*, received that appellation from the writer of the present article, in honour of John Stackhouse, esq. F.L.S. of Pendarvis, in Cornwall, author of a splendid work on submarine plants, entitled *Nereis Britannica*, and of some botanical illustrations of Theophrastus.—Sm. Tr. of Linn. Soc. v. 4. 218. Brown Bot. of Terra Australis, 23.—Class and order, *Pentandria Trigynia*. Nat. Ord. *Terebinaceæ*, Juss.? Sm. *Stackhouseæ*, Brown.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, bell-shaped, divided half way down into five equal, acute segments, permanent. *Cor.* Petals five, equal, inserted into the calyx, linear-lanceolate, cohering by their claws in the form of a tube much longer than the calyx, their borders narrow, spreading horizontally, shorter than the tube. *Stam.* Filaments five, thread-shaped, unequal, inserted into the calyx; anthers roundish, concealed within the corolla. *Pist.* Germen superior, three-lobed; styles three, short; stigmas obtuse, simple. *Peric.* Capsule of three roundish, coriaceous, corrugated cells, each of one valve, not bursting. *Seeds* solitary, nearly globular, attached to the permanent central column.

Eff. Ch. Calyx in five segments. Petals five, connected by their claws. Capsule of three lobes and three cells, not bursting. Seeds solitary.

Obf. The styles, as well as the cells of the capsule, are sometimes two only.

1. *S. viminea*. Slender Stackhouseia.—Gathered near Port Jackson, New South Wales, by John White, M.D. to whom we are obliged for specimens. The root is tapering, whether annual or perennial we know not. *Stems* several, erect, twelve or eighteen inches high, simple or branched, round, leafy, striated, smooth. *Leaves* scattered, sessile, slightly spreading, elliptic-lanceolate, or oblong, obtuse, entire, smooth, rather fleshy, and somewhat glaucous, single-ribbed, an inch or more in length, tapering at the base. *Clusters* terminal, elongated, erect, many-flowered. *Flowers* small, yellowish, in little distant tufts, two or three together, on short partial stalks, with minute bractæas at their base. *Capsule* of three rugged lobes, each the size of a mustard-seed, subtended by the permanent expanded calyx. The flowers bear a resemblance to some species of *Struthiola* or *Daphne*, but are very different when examined.

This is the only species that has fallen in our way. Mr. Brown probably may have seen more. This learned botanist considers *Stackhouseia*, "and an unpublished genus, exactly agreeing with it in flower, but remarkably different in fruit," as forming a small natural order, sufficiently distinct from all hitherto established. He places it between his *Celastrineæ* and *Euphorbiaceæ*, "to both of which, but especially to the former, it seems to be related in a certain degree." Mr. Brown thus defines the order in question.

STACKHOUSEÆ. *Calyx* of one leaf, in five equal segments, with a swelling tube. *Petals* five, equal, inserted into the top of the tube; their claws cohering in a tubular form, longer than the calyx. Their borders narrow, spreading like a star. *Stamens* five, distinct, unequal (two alternate ones being the shortest) inserted into the throat of the calyx. *Germen* distinct, of from three to five separate single-seeded lobes, the seeds erect. *Styles* three to five, sometimes cohering at their base. *Stigmas* undivided. *Seed-vessel* of

three to five lobes, each without valves, sometimes winged; the central column permanent. *Embryo* erect, central, almost as long as the fleshy albumen.

The plants of this order are herbaceous, with simple, entire, scattered, sometimes minute, *leaves*, and lateral, extremely minute, *stipulas*. *Spikes* terminal, with three *bractæas* to each *flower*. "The *Stackhouseæ* are peculiar to Terra Australis, and though found chiefly in its principal parallel, extend more sparingly both to the southern extremity of Van Diemen's island, and to the north coast of New Holland."

STACKING, in *Agriculture*, the art and manner of forming, building, and making all sorts of stacks with any kind of farm produce.

In forming, building, or stacking any sort of material of the farm kind, it is mostly proper to begin in the middle of the staddles or stands on which they are to be raised, so as to form and lay it out to the sides, ends, or other parts, in a very slightly inclining manner, the ear-parts the highest in corn or other similar matters, keeping such middle part always well up, and the outside parts on the sides, or in other ways, in a constantly very gradual, but scarcely perceptible, outwardly swelling or overhanging manner, proceeding course after course, in the same way, until the top of the stem or shaft part of the stack be reached, from which, in forming the top part, it is to be taken or drawn in, in placing the different courses of the substances in nearly the same easy, gradual, though in rather a quicker manner, until the ridge or top be arrived at; always carefully keeping up the middle, as in the stem or shaft part. The top or ridge part must constantly be well and safely secured; it is sometimes ornamentally formed. In somewhat this way every sort of stack about a farm may be raised without any very great difficulty or trouble, if the labourer or person who is to form and construct them be but a little conversant with the nature and practice of stacking, though he may not be greatly experienced in this sort of business. He cannot, however, raise or form stacks in the very neat, exact, and perfect manner, that complete and professed stack-building labourers are capable of performing the work. Nor will he be capable of finishing them with the same exactness, or the same degree of neatness or elegance. See the next article.

STACKING of Grain, the art and practice of building or forming stacks of corn, and other similar matters; which is performed in different methods, according to the particular nature and circumstances of the different cases. In the execution of this business, the stems of the stacks should, however, in general, be so formed as to swell gradually outwards, quite up to the part termed the eaves, as by this method they are more perfectly secured against the entrance of moisture, and at the same time require a less space to stand or rest upon. And when the building of them is well performed, they have equal solidity, and stand in as firm and safe a manner. But Mr. Marshall, who has probably not fully considered the advantages of this practice, advises that the stem or body of the stack should be carried up as plumb as possible, except the last course of sheaves, which should project five or six inches, to form the eaves: for the weight of the roof will, he thinks, press out the upper part of the stem sufficiently. If it overhang in making, its own weight and the weight of the roof will, it is supposed, squeeze it too flat, will spoil the appearance of it, and waste both thatch and time in thatching. The stem or body of a stack should commonly contain about two-thirds, and the roof one-third of the whole stack. If it be built on a frame, the stem should, however, contain less, and the roof more;

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more; if on a bottom, the reverse. The corners of the item should not be built too sharp; should be carried up snug; by which the sides will look fuller, and the swell given by the pressure will be more perceptible. The ends of the roof should have a gentle projection, answerable to the stem; and the sides should be carried up rather convex, than flat or concave. Perhaps a roof greatly convex shoots off the rains preferably to any other. A corn-stack should not, it is said, contain above twenty-one loads, as the risk of making and getting in is much less on a small than on a large stack; besides, a large stack does not settle so true as a small one, and of course will not stand the weather so well. It is true, a large stack does not, in proportion, take so much thatch and thatching, which are its only advantages.

But in cases where corn is stacked in a loose manner, it is the usual practice to have a number of persons upon the stack, the corn being forked up and deposited on the different sides all round in a similar method; after this, other parcels are laid all round on the inside of these, so as to bind them in a secure manner from slipping outward; the operator proceeding in the same manner till the whole of the middle space is perfectly filled up; when he begins another course in the same method, and goes on in this mode, with course after course, till he has raised the whole of the stem or body part; then he begins to take in for the roof in a very gradual manner, in every succeeding course, until the whole is brought to a ridge or point, according to the manner the stack is formed in. But in order that the roofs may throw off the water in a more perfect and effectual manner, they should be made so as to have a slight degree of fulness or swell about the middle of them, and not be made flat, as is too frequently the practice with indifferent builders of stacks of this sort.

The method of proceeding where the corn is bound into sheaves, is, however, quite different, as there is seldom more than one person employed in managing the work of building the stack, except in cases where the dimensions are very considerable; in which cases it is found necessary to have a boy to receive the sheaves from the pitcher, and hand them to the man that builds the stack. And in executing the work, it is of the utmost importance that the centre of the stack be constantly kept in a somewhat raised state above that of the sides, as by this means the sheaves have a sloping direction outwards, by which the entrance of moisture is more effectually guarded against and prevented. And in order to accomplish this in the most perfect method, it is said to be the best practice for the workman to begin in the middle of the stand or saddle, setting the sheaves together, so as that they may incline a little against each other, placing the rest in successive rows against them, till he comes to the outside, when he carries a course of sheaves quite round, and in a more sloping manner than in the preceding courses. The bottom of the stack being formed in this way, it is afterwards usual to begin at the outside, and advance with different courses round the whole, placing each course a little within the other, so as to bind them in an exact and careful manner, till the stacker comes to the middle. And all the different courses are to be laid on in a similar manner, until the whole of the stem is raised and completed; when the last outside row of sheaves is, in most cases, placed a very little more out than the others, in order to form a sort of projection for the eaves, that the water may be thrown off more effectually. But in cases where the stems of the stacks are formed so as to project outwards, in the manner already noticed, this may be omitted without any bad consequences, as the water will be thrown off easily without touching the walls of the stack. And the roof is to be formed by placing

the sheaves gradually a little more in and in, in every course, until it comes to a ridge or point, according to the form of the stack, as has been already observed. But in forming and constructing this part of the stack, great care should constantly be taken to give the ear-ends of the sheaves a sufficiently sloping direction upwards, in order that they may be the better secured from wetness. And to the outside should be given a rounded form, in the manner that has been already noticed.

In respect to the stacking of grain, it is observed in the Farmer's Magazine, that the corn and its straw must necessarily be a great deal more dried in the field, to render it proper for being secured in barns, than when it is built in ricks, as these latter, being exposed to the free air all round, are by no means so apt to heat or mould the grain and straw, as if it were stored in common barns. And that, in consequence of that superior degree of dryness necessary for barn-harvesting, the grain is certainly a great deal more apt to shake out from the ear, in handling and forking into the carts or waggons for being led home. And further, that when built in ricks properly contrived, the grain is likewise placed altogether out of the reach of rats and mice, which commit very great waste in common barns, however well constructed; that it is of course better that all grain should be built in round ricks in the yard, upon wooden frames open below, raised on stone supports, similar to those on which granaries are fixed. By this plan, it would, it is supposed, be more effectually secured against the depredations of vermin; and besides, the air having free access all round, and even underneath, through the interstices of the frame, it will be completely prevented from all danger of spoiling any way in the rick. And further, that in this way of securing grain, the ricks do not by any means require to be thatched so very substantially, and, of consequence, expensively, as is practised in general.

Further, it is also advised, that in building a corn-rick, effectual care be taken to keep the centre or heart of the rick always considerably higher than the outer range of sheaves, as noticed above; so that every sheaf in the rick has a considerable slope outwards and downwards. When this is properly attended to, and all the sheaves carefully locked together, and the crown properly put on, the rick will, it is observed, turn a very heavy shower of rain, even before the thatch is applied. The whole rick, after the thatch is laid on, is finally covered with a net-work of straw-ropes, leaving the meshes about nine or twelve inches wide, all the ends of the ropes being secured to a belt-rope, which goes round the rick below the eaves, just within reach of a man, and the middle parts of all the ropes are tied to one that goes straight over the top of the rick by small handfuls of straw. See STACK.

And it has been stated by the author of "Practical Agriculture," that it is the practice in some districts, especially where the stacks are made of a circular form, and the weather is wet and unfavourable, to have a funnel or chimney left in them, in order to prevent their taking on too much heat. This is effected by tying a sheaf up in a very tight manner, and placing it in the middle, on the foundation of the stack, pulling it up occasionally as the building of the stack proceeds all round it. And in setting up ricks in bad harvests, it is a practice in some places, particularly with barley-crops, to have three or four pretty large poles tied together, by winding straw-ropes round them, set up in the middle, round which the stacks are then built. But that except the stacks are large, or the grain when put into them in an imperfect condition, such openings are quite unnecessary. These openings in the northern parts of the

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kingdom are denominated *favuses*, or *faufes*. And it is probable that in some instances they may be prejudicial to the stacks, by the admission of too much moist air. See *HARVESTING of Grain*.

A curious practice in this mode of stacking grain prevails in some parts of the northern districts of the kingdom, where the operation is performed round about a high conical frame of wood, which has, in some cases, a small door, provincially termed a *logie*, formed in it on the side or quarter from which the wind commonly blows, in order that a more free admission of air may be secured, a lateral vent, or small opening, being sometimes, perhaps, made in the body, a little below the point of the wooden frame, which has in different parts of these districts of country the names of *faufe* house and *windy* house. The writer of the Corrected Account of the Agriculture of the County of Inverness suggests, that where wood is scarce, the same effect and advantage may nearly be produced, without an upright timber-frame, by filling a sack with straw or hay, and fixing a rope to the mouth of it. This sack is set down adjoining to the logie, and in the centre of the space on which the stack is to be built; and as the stacking advances, the sack is gradually pulled up, so far as is thought necessary and useful, by which means a future draught of air is freely admitted. These precautions are, however, it is said, mostly used when the material is damp, and the stack to be formed on the ground. See *STADDLE*.

In some damp situations and moist wet seasons, grain is occasionally stacked up in the field in different forms and methods. The writer of the Account of the Husbandry of Middlesex has remarked, that to the westward of the city of Bath, the excessive moisture of the climate has necessarily induced and obliged the occupiers of arable land to secure their corn or grain crops in the field, immediately after they are bound into sheaves, by stacking them in round ricks or stacks, which contain about a cart-load each; the sheaves being placed in such a manner as to secure the ears equally against the rain and damp arising from the ground. They are set on their butt-ends in the bottom parts, but every sheaf, from the eaves upwards, is placed sloping in a thatch-like manner, and in the form of a cone. One sheaf is inverted at the top, and spread over this cone-like point; which method secures the whole, until it may suit the convenience of the farmer to carry the matters to be re-stacked, or built up in the barns or stack-yards. When these ricks or stacks are well made or put up, they are secure, it is said, against every possible quantity of rain, and for any reasonable length of time; even for a whole winter, if it were necessary to keep them out so long. This is a practice of stacking in the field, which, it is thought, deserves imitation in all wet climates, and indeed in all others, in cases of wet harvest seasons.

The method of stacking or making the arish mow or stack, which is another mode of stacking grain in the field in some of the south-western districts of the kingdom, is thus described by the writer of the "Western Tour." A sort of cone or pyramid is first formed with sheaves set upon their butt-ends, and in a leaning manner towards their centre; the workman then gets upon them with his knees, an assistant putting the sheaves in their proper places before him, while he creeps or crawls round the mow or stack, forcing and beating them down in a perfect manner with his knees applied about the binding-place; and continuing in this manner to lay course after course, until the mow or stack be deemed high enough; observing to contract the dimensions of it as it rises in height, and to set the sheaves more and more upright, until they form at the top a sharp point, which is

capped with an inverted sheaf, either of corn or reed. In cases where corn or grain is put up or built in these stacks, it is mostly thought to be quite safe.

The stacking of corn, when carried to the yards, is frequently performed on oblong and other forms of raised wood, on frames covered with loose poles or other matters, so as to admit air freely to all parts of the bottoms of the mows or stacks, and at the same time to prevent rats and other such animals getting into them.

The stacking of grain is mostly performed in a neat and exact manner in many districts towards the middle and more northern parts of the kingdom; but in many of the more southern and eastern counties, it is often done in an extremely bad and slovenly manner. In Oxfordshire and Berkshire stacks are formed with peculiar neatness, and have much merit in their different forms and shapes, being not unfrequently duly arranged, and placed in neat clean stack-yards. In the latter of the above counties, it has been remarked, that a farmer who was negligent in these respects, would be the object of observation and derision in his neighbourhood. And that the labourer who can make a handsome rick or stack, prides himself on his skill; and as good as well as bad examples are catching, others, in imitation, endeavour to gain credit by the same means.

In finishing the stacking of grain in many places, the stem or body parts of the stacks or mows are neatly pared round, in order to prevent the vermin, which might leap against them, from finding any thing to hold by; and the whole is completed in a neat and exact manner.

STACKING of Hay, the work or business of putting hay up into ricks or stacks. This is an art which requires much care and attention in the person employed for the purpose, though much less than that of building corn-stacks. There should constantly, though it is often too much neglected, be a proper stand or foundation, somewhat raised by wood or other materials, prepared for placing the stacks upon; but nothing of the shelving outward direction or of the coping kind is here necessary. See *STACK*, *STADDLE*, and *STAND*.

It may be noticed, that in performing the business of stacking hay, the work should constantly be performed as much as possible while the sun is upon the hay, as much advantage is thus gained in the quality of the hay: and it is necessary to have a stacker that has been accustomed to the business, and a proper number of persons to help upon the stack, in order that it may be well spread out and trodden down. The building of these sorts of stacks should be conducted much in the same way as those of the grain kind; the middle of the stack being always well kept up, a little higher than the sides, and the sides and ends be well bound in by the proper application of the successive portions of hay as the work advances; and during which it is a good way, where there are plenty of hands, to have the sides and ends properly pulled into form, as by this means much after-labour is prevented. It is likewise of advantage, that the hay should be well shaken and broken from the lumps during the operation of stacking. The form in which the stacks are built is not, as has been already seen in speaking of stacks, of much consequence. See *STACK*.

With the intention of preventing too much heat, sometimes in building these stacks, as well as those of the grain kind, holes, pipes, and chimnies are left in the middle, that the excessive heat may be discharged. But there is often injury sustained by them, from their attracting too much moisture. See *HAY*, and *HAY-making*.

For this purpose, square spouts or troughs, bored full of large holes, and two opposite boards, secured about nine inches apart, by nailing short laths on them, are sometimes employed;

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employed; as well as the drawing up the middle of the stacks, while they are building, a basket or a sack full of hay, straw, or other similar materials. And in some cases, on the stacks heating too much, square openings are cut from the tops to the bottoms of them.

In stacking of hay, the use of salt has likewise been found to have the valuable property of keeping it from heating too much in such situations, and, by that means, preserving it of a finer green colour than would otherwise be the case. Its disposition to counteract or prevent heat is so great, it is said, in such cases, as to render it particularly suitable, proper, and valuable in every instance where it may be suspected that the hay has been put together without being sufficiently made.

The hard benty hay of poor uplands may mostly be stacked up without any risk or danger of heating too much; but that which is of a more open succulent nature and quality, on rich or highly manured lands, is for the most part very liable to take on too great a degree of heat, and should consequently be longer delayed in stacking, as well as put up in smaller quantities together, in order to avoid being injured by being burnt in the mow or stack.

The hay of clover, tare, faintfoin, and some other similar kinds of grasses, are commonly more disposed to heat in too great a degree than almost any other sorts when put up in stacks, not only on account of their being more succulent and fatty, but in consequence of their nature requiring that they should be a good deal less made, in order to preserve their foliage as perfectly as possible. In stacking them, therefore, these circumstances should be carefully attended to and kept in mind, and smaller, as well as more loosely formed stacks of them raised. In the county of Middlesex also, many farmers are said to make use of salt, in such cases, with very good effect, in keeping down the heat.

Where there are great quantities of hay ready on hand at the same time, it is of much consequence that it should all be stacked up as soon as ever it is fully made, which, though difficult to be accomplished in many cases, should seldom be neglected, as its weight and good quality greatly depend upon it, there being every moment from that time a loss in the weight, as well as the nutritious properties of it, by what is forced off by heat into the atmosphere. The difference of even a few hours in very hot seasons, may, it is supposed, be the cause of a loss of fifteen or twenty *per centum* on the hay, by its having been carried beyond the point of perfection in making; and not infrequently a much greater loss is sustained. The stacking, therefore, in such circumstances, should always be done as expeditiously as possible.

In regard to the loss of the materials before and after they have been stacked up, it has been supposed by the writer of the Middlesex Agricultural Report, that four hundred weight of grass wastes in forming into hay, three hundred before it is ready for stacking; it is then further reduced by heat and evaporation, in about the space of a month, to perhaps ninety-five pounds; that at between that and ninety, it is apprehended it continues throughout the winter. That from about the beginning of spring until the commencement of the following autumn, the different operations of trussing and conveying it away, render it considerably lighter, probably to eighty, by exposing it so much to the sun and wind: that is, such hay as would weigh ninety pounds on being taken from the stack, would be reduced to eighty by the time it is disposed of, as in the course of twenty-four hours. On such stacked hay being kept longer, little or nothing is lost in the succeeding winter: it is nearly obvious, it is thought, that the same stacked hay will weigh on being disposed of eighty pounds in the summer, and ninety in the

winter. From this circumstance, and some others which relate to price, the farmer may, it is conceived, determine what season of the year is the most advantageous and proper for him to dispose of his stacked hay: on large hay-farms stacked hay is sometimes kept for four or five years, and there are not unfrequently very large quantities of hay on them in this state.

The stacking or mowing of hay is sometimes performed in large hay-barns constructed for the purpose, which are found to be extremely useful and convenient on many occasions, as well as to produce considerable savings in different ways, besides the safety which they afford. See *STACK Hay-Barn*.

After the work of stacking the hay has been finished, and the stack been properly pulled and topped up, it may be left until it has sweated, and is become perfectly settled, which mostly takes place in the course of a week or two. It is then ready for thatching. See *THATCHING of Stacks*.

It may likewise be noticed, that in building the upper parts of these, as well as grain and other stacks, the use of a stage often becomes necessary, in order that the materials may be pitched more conveniently to the stacker, as has been seen under the head *STACK*. See *STACKING-Stage*.

STACKING of Pulse Crops, the art and practice of putting all the sorts of farm produce, which have pods in the place of ears, up into stacks. It is always necessary, in building them, to keep the pod parts, as much as possible, from being exposed to the action and effects of the atmosphere, as they are very liable to be much injured or quite spoiled by the influence of much moisture or wetness, whether communicated by the air or in any other manner. It is consequently proper in stacking up these different materials, to always let the stem or root-ends of the crops have an outward direction and appearance, they being bound inwardly by such wads, sheaves, or bundles as have but little stem or root parts in them, which is mostly sufficiently the case in all such sorts of produce. The middle parts of such stacks should always be kept well filled up with such materials while building. The stem or shaft parts may mostly be carried up in a pretty plumb or upright manner, but if the outward side parts are made and carried up so as gradually to diverge or project a very little at the top or eave parts, it will be so much the better, and the stack will be so much the safer from the danger of the droppings of the rain-water or any other wetness that may fall upon it.

It is hardly ever necessary to carry up the top parts in constructing such stacks to any great height, the lower they are indeed the better, provided they are formed in a regular manner, and so as to effectually carry off the water that may fall upon them.

The topping-up of such sorts of stacks should never, however, be much delayed, as the seed of such kinds of produce readily swell, and are apt to become injured by a very little moisture in such situations.

These sorts of stacks, as well as those of other kinds, should always be built upon proper saddles in safe yards or other situations.

STACKING and preserving of Hop-Poles, the practice and method of piling them up in stacks, for the purpose of rendering them safe and secure against wind and bad weather; and the means of preparing their bottom parts against the injuries they may receive from the earth or soil in which they may be placed. See *Hop-Pole*.

In the square manner of stacking up hop-poles, the number of from thirty to forty or more are usually set up to each corner so as to form it, which should mostly stand eight, ten, or twelve feet apart in each or every direction at the

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bale or bottom parts of them, the top parts uniting, or coming as closely as possible into contact with each other. By this mode of proceeding, a fort of square inclining pile is formed, while sufficient openings or spaces are produced below and between them, for contributing to render the poles dry, as well as afterwards for preserving them, as much as possible, in that condition, and at the same time for letting the wind pass among them more freely, by which the danger of their being thrown down or overturned is considerably lessened, as in the case of stacks of the conical or circular form. In constructing this, as well as the other form of these stacks, a few poles are first well fixed up, fastened and secured at the top parts, and then set out in a firm spreading-out manner at the bottoms, so as that the proper quantity of poles may afterwards be regularly and gradually laid to them and constitute the stack.

The means of rendering the parts of hop-poles which are set into and come in immediate contact with the mould or soil less liable to decay and destruction than they are in the ordinary mode, is a matter of much consequence to those engaged in the cultivation of hops. The following process has been recommended by Mr. Vancouver, in the Corrected Account of the Agriculture of the County of Essex. Taking into full and due consideration, it is said, the very important benefits which are derived from coal-tar, in preventing the depredations of marine insects on plank and timber, it very naturally occurs, that a preparation of the same substance, judiciously applied, might not only produce a similar effect on and against insects in the ground. but, by its gradual and regular solution there, become matter of food for the nourishment of plants; and that this leads to a very important consideration, as that of how far the application of the same material may become serviceable, by prolonging the durability of posts set into the ground, and in the like manner for the preservation of the parts of hop-poles which are put into the earth, to which particular point, it is stated as the substance of a conversation on the subject with the earl of Dundonald, who has taken a great lead and interest in the invention, manufacture, and introduction of coal-tar into more general use, that he recommends the method of preparing the hop-poles with it, which is given below, to all hop planters.

The parts of the ends of the hop-poles which are intended to be set or inserted into the ground or soil, should first be stripped of their bark for the length of about thirty inches. The poles should then be pointed, and scorched or burnt, until the surface of them, from which the bark has been removed, becomes black, and in some sort charred. The usual or customary depth to which poles are set and fixed in the ground, will mostly regulate with exactness how much of the pointed ends of the poles should be treated in the above manner. The burnt end of the pole, while hot, should be dipped into thin coal-tar, which should previously be made a little warm, in order that the wood may absorb and take up as much of it as possible. There may perhaps, it is supposed, be an advantage in dipping or putting the pole the whole space of the thirty inches which is stripped of the bark, as by that means twelve inches of what is covered and laid over with coal-tar may be above the surface of the ground.

After the paying or coating of the poles with the tar has been completed, they are to be put up or stacked with their pointed and tarred ends upwards, until they become perfectly and quite sufficiently dry; after which they are to be dipped in coal-pitch made boiling hot, and then set up again in the same manner, to remain in that state until the time when they are wanted for use. In cases where the poles are liable to

injury at the upper or smaller ends, dipping them in the coal-tar might also, it is supposed, probably be of use in preventing the separation of the bark, or the harbouring of insects.

It is of very material consequence that the coating or tarring of the poles be performed at such a distance of time before they are wanted for use, as to allow of the whole covering becoming perfectly firm, hard, and dry. And likewise that the poles, before they are begun to be coated over with the tar, be in a quite dry condition, as they take up a much greater quantity of tar when in this situation, than when much loaded with moisture, as is too often the case.

The practice of burning or charring the bottom ends of hop-poles has also been found highly beneficial in preserving them from decay without the application of either the coal-tar or pitch, in many cases and situations, as well as some other methods. See Hop.

It is always proper to have the poles piled up in proper parcels together, or set upright against some sort of support in the hop-grounds, while they have the binds about them, until they can be disengaged from them, as well as afterwards, until they can be staked or pointed, prepared in the above manner, and set up into stacks, instead of having them dispersed all over the ground in a flat manner, as is the too usual custom, as by such means they will become readily more dry, be a great deal more free from injury, and at the same time be rendered more fit for receiving the preparation.

And in extensive plantations, it might probably be the safest, cheapest, and most convenient way, to have open coarse sheds with secure cheap roofs built for receiving and preserving them in, they being piled up in them upon low frames or flools with long arms or branches for keeping them up. In this manner they would in all probability be more readily, more perfectly, more conveniently, and more advantageously secured than in any other way; and thereby a great saving of poles most likely be produced.

STACKING of Straw and Stubble. Straw is often stacked up when bound in trusses, as well as when in the loose state. In the former mode, the different bundles should be stacked in as straight a manner as possible, in order to be kept for sale or other particular uses. In the latter state the stacks should be well pulled while they are forming, in order that they may be close and compact. In building the top parts of stacks of this nature, they need not be carried to any great height, but be so formed as to shoot off the water in a perfect manner.

STACKING-Bands, or Belts, the ropes or bands used in thatching stacks of different kinds, whether of the straw, hay, or other sorts.

STACKING-Stage, the scaffold or platform employed in building stacks of corn, hay, and many other sorts of farm produce.

Stages of these kinds are constructed in different ways, some being fixed together in a sort of frame, so as to be set up against the stack, and suited to the height of pitching by a moveable stage. Lately this sort of stage has been considerably improved, by being so contrived as to be capable of being readily taken in pieces and laid by. It is the contrivance of a gentleman in the county of Suffolk, and described in the Agricultural Survey of that district. It consists of two parts, one of which is a frame eight feet wide, made of two fir-balks twenty-two feet long, braced together in a parallel position, and having several holes bored in them, about fourteen feet from the ground, for the reception of the hinges of the stage; and a hook in each

of them, to hang the chains on which are to support the outward edge of the stage, and serve to raise or lower it at pleasure. The other part is a moveable stage eight feet long, and three feet eight inches broad, having a hinge under each end, at the hinder, or edge nearest the stack; one end of the hinges is made like a bolt, to enter the holes in the balks; the stage likewise has an iron-plate under each end, with a hole in it to receive a hook on the chain. It is added, that in using the stage it is set against the stack, when it grows so high that it is inconvenient to pitch on to it from the buck of an empty waggon. The holes in the balks most commonly used are fourteen feet from the ground, about the height of a waggon-load of hay. Should the stage be fixed lower, it would be of no use, not being wanted whilst a man can conveniently pitch from the buck of a waggon on to a stack; and should it be fixed much higher, it would be found too high for a man to pitch on to, when the waggon is nearly empty.

It has been suggested, that a stage like this is not expensive in the construction, and might be used for nailing up weather-boarding, painting, plastering of walls, and several other purposes.

STACKPOLE HEAD, in *Geography*, a cape on the S. coast of Wales. N. lat. $51^{\circ} 42'$. W. long. $4^{\circ} 57'$.

STACKS of Burgh, rocks near the E. part of Scotland, one mile W. of Duncansby Head. N. lat. $58^{\circ} 23'$. W. long. $2^{\circ} 57'$.

STACKS of Duncansby, rocks in the North sea, near the E. coast of Scotland; $1\frac{1}{2}$ mile S. from the mouth of Wick river. N. lat. $58^{\circ} 36'$. W. long. $2^{\circ} 57'$.

STACKS of Hempriggs, rocks in the North sea, two miles S. from the mouth of Wick river. N. lat. $58^{\circ} 21'$. W. long. $2^{\circ} 57'$.

STACTE, *στακτε*, in *Pharmacy*, a fatty resinous liquid matter, of the nature of a liquid myrrh.

This liquor is very odoriferous, and is held very precious; making alone the perfume called by Dioscorides *στακτε*, which, he says, smells finely, though very bitter to the taste. We have none of it now but what is sophisticated; and what the apothecaries call *στακτε*, is usually no more than liquid storax.

STADARSTAD, in *Geography*, a group of buildings, comprising a church, the habitation of the minister, and a few cottages, in Iceland, situated in the peninsula terminated by SNÆFELL's *Syffel* (which see.) This church was the best which the travellers to whose account we refer had seen, except that of Bessildad. It is constructed entirely of wood, and has a pretty large gallery. The mountains that rise behind Stadarstad are very lofty, and present a bold and precipitous front towards the sea. About six miles from Stadarstad, in the mountains that approach towards the sea, is a hot spring, in a place called Lyfiehous. The water issues from the top of a mount about ten feet high, and fifty yards in diameter, entirely calcareous. The temperature of the spring was 96° , and the water had an acidulous taste. Not far from the mount were great quantities of incrustations not calcareous, which had evidently been formed by some ancient springs. About half a mile from the spring is a stream of lava, that had flown down from the precipices above, and spread over the flat plain intervening between the mountains and the sea. Near Buderstad, which is one of the trading stations of Iceland, and consists of a merchant's house, a large wooden storehouse, a church, and a considerable number of cottages, is an other mineral water, the taste of which was similar to that of Lyfiehous; the temperature was 46° . Mackenzie's Travels in Iceland.

STADDLE, in *Agriculture*, a term applied to the bot-

tom part, or that on which the stack or mow of corn, pulse, straw, hay, or any other sort of field produce, rests, and is formed or built. These sorts of staddles are contrived in many different ways, according to different occasions and circumstances; as, in a walled manner, in the wooden frame method, in the simple log mode, and some others. The two first are, however, by far the most proper, where grain or pulse is to be stacked upon them; but the last may do for straw and hay occasionally, where better and more perfect methods cannot be adopted or put in practice. The first method is expensive, and therefore not common. See *Corn-STAND*.

A method more commonly adopted by farmers, is that of the wooden frame, resting upon low supporters of the stone or other kinds. In many different districts, the staddles, especially for corn, are constructed by means of upright stones with caps, placed about seven feet distance from each other, in a circular, square, or some other suitable form. The upright stone, in some cases, is a truncated pyramid, about four feet in length, a foot being allowed to be let into the ground. On the top, which is about four inches in the square, is placed the cap, which is a round stone, flat and smooth on the under side, and a little convex on the upper, two feet in diameter, and projecting ten inches from every side of the upright stone. Upon these stones strong timbers are framed, first extending in a cross-wise direction, and then all around the sides; a stone and cap being, for the most part, put in the centre, to take off the bearing of the cross-timbers. This is a plan of staddle, which, it is thought by many, effectually secures the grain against rats and other similar sorts of vermin.

In other situations, stone or wooden pillars are put down, at proper distances from each other, into the ground, upon which is laid a firm and strong substantial timber-frame, well compacted and put together, of joists, beams, and other parts, as may be found necessary and expedient. If the supporting pillars be of stone, they are usually of a conical form, with stone caps faced upon their tops, as above; but if of wood, they are cased with tin, ten, twelve, or more inches near their upper ends. In the former case, the stone caps, and, in the latter, the tin coverings, effectually prevent, it is supposed, the rats and mice from climbing up into the stacks.

In some of the more northern districts of the country, the corn-stacks are occasionally set somewhat in the form and manner of little houses, upon pillars, or arches turned in masonry, round or on one or more of the most exposed sides of the straw-yards, where the outlying or other cattle are to be foddered and kept. Where the pillar mode is adopted, a strong solid wall, built in mason work, mostly forms the outside, and the pillars are set round or on the insides of the straw-yards. Beams of a proper size and length are first laid from one pillar to another, and then rafters are laid across from the outside wall to the pillars and beams, so as to form a sort of flooring; upon which the stacks are built of any length and height that may be necessary; their roofs being always well secured. In the turned arch manner, no pillars or frames of wood are at all necessary, the top parts of the arches forming the bases or staddles for raising the stacks upon, while the openings of them, or arches below, form the stalls for the cattle. In both these ways the cattle are well protected below or underneath the stacks; the grain is perfectly preserved from the effects of dampness and vermin, by being so much elevated; and to the former there is a considerable saving of manure in different ways.

In other cases, corn-stacks are built round and against a frame of wood, set up firmly in somewhat a conical shape
or

or manner; the tops of the rafters or boards, of which this sort of staddle is composed, resting or inclining against each other, and reaching somewhat above the eaves of the stack. This is a kind of staddle which is supposed to afford much air and ventilation in moist damp situations, for drying the grain in the stacks. See *STACKING of Grain*.

Where the simple log manner of forming staddles is in use, any sort of rough large pieces of wood, of the tree or other kind, are laid round the outsides, in the form in which the stacks are to be made; in the inside and middle of which, bottoms or foundations are formed with common wood faggots, bushes, or any other similar matters; the whole being then well covered with rough straw or haulm of any sort. See *STACKING of Hay*, and *STAND, Grain*.

The term *staddle*, likewise, sometimes signifies a tree, which is suffered to grow for coarse or common purposes; as the forming and making of posts, rails, and other similar uses.

STADDLE of Hay, a term applied to a plot or portion of hay thrown abroad in making. See *HAY-Making*.

STADDLE-ROOF, any sort of roof or covering which is placed over staddles, and employed for the purpose of protecting or securing the stacks of either corn or hay, or of any other sorts of materials which are built upon them. Staddle-roofs are of many different kinds, and their heights and sizes are various, according to those of the staddles over which they are laid.

In the county of Devon, a mode of this kind of roof prevails for the securing of corn, in some parts of the South-hams in that district, which appears to be entitled to the consideration of the farmer.

It is said to have been borrowed from the Dutch, as it is much used in Holland, and all the low countries upon the borders of the Rhine and Scheldt rivers. It is likewise stated to be almost universally had recourse to throughout the eastern and middle states of North America. And it probably exists in different other countries and districts.

It consists of a light moveable roof, formed of some sort of suitable and convenient materials for the purpose, which is capable of being raised or let down at pleasure over the staddle upon which the stack is built. The methods of forming and managing the arrangement of it are these. At the distance of about four feet from the corners of the staddle or stack-frame, are sunk four strong boxes, well rammed and secured in the ground, and of sufficient capacity to receive about three feet in length of a large pole or spar, rounded from a square of six inches, being made a little tapering towards the top, and thirty feet in length: on the upper end of this spar or pole is fixed a stout ring or ferrule, from which is projected a strong iron hook: the four posts or poles thus formed and fitted up are placed in the boxes at the different corners of the staddle. A two-sheave tackle is then hitched to the hooks at the tops of the poles or posts, and a one-sheave tackle to each corner of the roof, resting upon the staddle, and presenting at each corner a portable hoop, or collar, to enclose the different poles or posts on which it traverses up and down, keeping all firm, steady, tight, and compact together. These four tackles are manned with as many persons as may be found necessary to raise or lower the roof, and thus every sheaf of grain, or any other substance, which is brought home to be stacked under these staddle-roofs, is said to be more immediately and better secured from future damage, than if they were any otherwise placed under cover, or even stowed away in a barn or other similar building. This staddle-roof contrivance is said to be denominated a hay-barrack in the

state of Pennsylvania, in North America, in which district they are equally used for the purpose of protecting hay as well as corn.

It is noticed, that in climates or tracts of country which are frequently liable to sudden and violent storms, or thunder-showers, during the periods of hay-time and harvest, these staddle-roofs are mostly found particularly useful, proper, and necessary for the farmer, in preserving his crops of these kinds in the best and readiest manner.

The loose staddle-roofs, used in some situations, are mostly formed of some sort of very light thin boards of different extents, as ten, twelve, or more feet in length, and which are sometimes bent or curved on one side, and hollowed in the middle, in somewhat the manner of the pan-tiles which are used in covering buildings, so as to hook on to each other and carry off the wet. Roof-boards of this sort are in use on the farms at Winwick, one of the seats of the earl of Derby, in Lancashire, and found to answer the purpose very well, and to be particularly serviceable in showery or rainy seasons.

Staddle-roofs of the cloth kind are sometimes employed; the old sails of ships and other similar sorts of cloth being provided for the purpose.

STADDLE-Stones, those which are made use of in the construction of staddles, especially when they are intended for the purpose of corn, in order to keep rats and other sorts of vermin out of the stacks; and also for granaries, to keep them from climbing up into them. Various kinds of stones are employed in this way, as those of the free-stone, the slate-stone, the lime-stone, and different other kinds. See *STADDLE*.

Staddle-stones are mostly employed also for granaries, wherever the primary consideration of the farmer is the security of his corn. In these cases, the old method was to have them only put at the corners, while the buildings stood upon a frame of wood, but the improved mode is to have them coped all round, in somewhat the same manner as corn-stands, in order that they may be perfectly secure against the inroads of destructive vermin.

For granaries placed on staddle-stones, it has been lately suggested, in order to prevent vermin from getting up the outward steps, that such steps should be fixed on the inside of the lower parts of the door, which are to be balanced with weights, so that a slight effort may be capable of bringing them down on blocks of stone, which are to form the first steps for the purpose, such blocks of stone being twenty-four feet by fourteen in the clear. The doors, in such cases, must, of course, project in some degree in being brought forward, so as to reach the ground, or come near to it, for the purpose of affording a ready and easy entrance into the repositories.

STADE, in *Geography*, a town of the duchy of Bremen, with a strong fort, on a small river, about a mile from the Elbe; formerly the capital of a county and residence of the counts. It is now the seat of the regency of the duchies of Bremen and Verden, and also of the chancery, chief court of justice, and consistory, and contains three churches. Its two burgo-masters are counsellors of state. It was formerly a place of considerable trade, and from the year 1586 to 1612, an English staple, which was removed to Hamburg. After having undergone several revolutions and changes of masters, it was occupied in 1715 by the troops of Brunswick. In 1757 the fortifications of it were completed; 24 miles W. of Hamburg. N. lat. 53° 42'. E. long. 9° 21'.

STADECKEN, a town of Germany, in the palatinate of the Rhine; 11 miles W. of Oppenheim.

STADELHOFEN, a town of Bavaria, in the bishopric of

of Bamberg; 6 miles S.S.W. of Weifmain.—Also, a town of the duchy of Wurzburg; 7 miles S.S.E. of Gemunden.

STADEN, a town of France, in the department of the Lys; 7 miles S.E. of Dixmude.—Also, a river of Germany, which runs into the Nidda, 10 miles N. of Francfort on the Maine.—Also, a town of Germany; 20 miles N.E. of Francfort on the Maine.

STADIUM, σταδιον, an ancient Greek long measure, containing one hundred and twenty-five geometrical paces, or six hundred and twenty-five Roman feet; corresponding to our furlong.

The word is formed from the Greek στασις, station; and it is said, on this occasion, that Hercules, after running so far at one breath, stood still. The Greeks measured all their distances by stadia, which they call σταδίζεω.

Eight stadia make a geometrical or Roman mile; and twenty, according to M. Dacier, a French league; but according to others, eight hundred stadia make forty-one and two-thirds of a league.

Guillette observes, that the stadium was only six hundred Athenian feet, which amount to six hundred and twenty-five Roman, five hundred and sixty-six French royal feet, or six hundred and four English feet; so that the stadium should only have been one hundred and thirteen geometrical paces. It must be observed, however, that the stadium was different in different times and places. See MEASURES.

STADIUM was also the course, or career, in which the Greeks ran their races.

It is said to have derived its name from the measure of length mentioned in the preceding article; which being equal to the space of ground allotted for the foot-race, the course was from thence called the stadium, and the racers were named stadicis, or stadiodromi. The Eleans, indeed, pretended, that the stadium at Olympia was measured by the foot of Hercules, which being longer than that of an ordinary man, made their stadium longer than any other in the same proportion.

Vitruvius describes it as an open space one hundred and twenty-five paces long, terminated at the two extremes with two posts, called *carcer* and *meta*.

Along it was built a kind of amphitheatre, where the spectators were placed to see the athletæ exercise running, wrestling, &c.

Pausanias (lib. vi.) informs us, that the Olympic stadium was a terrace composed of earth; on one side of which was the seat of the Hellenodicks, or Hellenodics (see HELLENODICÆ), and over-against them on the other, was an altar of white marble, upon which the priests of Ceres Chamyne, and some virgins, had the privilege to sit and view the games. At the farther end of the stadium was the barrier, whence those who ran the simple foot-race began their course; and there, according to the tradition of the Eleans, was the tomb of Endymion.

According to the description given by Wheeler, in his travels, of the remains of the stadium at Athens, which was built by Herodes Atticus, it appears to have been a long place, with two parallel sides, closed up circularly at the east end, and open towards the other end, and about one hundred and twenty-five geometrical paces long, and twenty-six or twenty-seven broad, which gave it the name of a stadium.

Though the Olympic stadium does not seem to have been so splendid as this at Athens, or another at Delphi, built likewise of marble by the same magnificent citizen of Athens, yet we may suppose they were all formed upon the same mo-

del, as they were destined to the same use. In the stadium were exhibited those games which are properly called gymnastic. At either end of the course stood a pillar, the one constituting the barrier where the race began, and the other the goal, where the simple foot-race, instituted or revived by Iphitus, ended.

In the fourteenth Olympiad was added the *dioulos*, or double stadium; and the *diulodromoi*, who ran this race, turned round the pillar erected for that purpose at the end of the stadium, and returned to the barrier, where their race terminated. But the *dolichodromoi*, or runners in the race called *dolichos*, or the long course, which was introduced in the fifteenth Olympiad, and which consisted of seven, or twelve, or even of twenty-four stadia, when they came to the barrier, turned again round the pillar erected at that end, in order to continue their course, which required many doublings of the stadium.

The stadium, or race-ground, called the Olympic *hippodrome*, consisted of two parts; the first resembled in shape the prow of a ship, and was called the *barrier*. In this place were the stands for the horses and chariots, and here they were matched and prepared for the course. The next partition was the *lists*, or the spot on which the races were to be run. At the end of the course stood a pillar, which was the goal, round which the candidates were to turn; and that rider or driver who could make the narrowest turn and approach nearest to it, had the fairest chance, *ceteris paribus*, of surpassing his rivals. To this Horace alludes in the expression, *Meta fervidis evitata rotis*. Beyond this goal, there was a figure placed on purpose to frighten the horses, called *Taraxippus*, or the *terrifier of horses*. It is probable, that some tricks were practised under the disguise of this figure, to render the victory more difficult, and of course more honourable, or to try and prove the resolution and temper of the horses. On each side of the course, from one end to the other, the spectators were placed; the most advantageous stations being assigned to the judges of the games, and other distinguished persons. In that place where the horses stood which were to run, a long cable was drawn from one side to the other, which served the purpose of a barrier; about the middle of the prow already mentioned, an altar was erected, upon which stood a brazen eagle with outstretched wings, and the figure of a brazen dolphin was likewise placed at the entrance of it. This last was so contrived, that when the president of the races thought proper to put it in motion, it would ascend at once to such a height, as to be visible to all the spectators. This eagle was dedicated to Jupiter, the patron god of the Olympic games, as the dolphin was sacred to Neptune, the supposed creator of the horse. In the moment when the eagle sprang into the air, the dolphin sunk under ground; and upon this signal, the cable was removed, and the horses advanced from the stands into the course, where they stood ready to start. The signal for starting was probably the same as in the chariot races, and was given by the sounding of a trumpet. The space of ground round which the horses were to run, and the number of times which they were required to run round it, will make their course or heat to amount to about four miles, or somewhat more. See on this subject West's Odes of Pindar, and Preliminary Dissertation on the Olympic Games, p. 43, &c. p. 84, &c. For other particulars, see HIPPODROME.

There were stadia likewise covered over, and encompassed with colonnades and porticoes, serving for the same exercises in bad weather. Captive children used to run the stadium.

A more natural derivation of the word stadium, from στασις,

statis, station, than that popular one mentioned in the last article, may be drawn from the *athletæ* stopping and resting when at the end of this course: whence the name might be applied to the same distance measured in any other place.

STADIUS, JOHN, in *Biography*, a German astronomer, was born in 1527. and studied at the university of Louvain, where he applied himself with so much diligence to mathematical pursuits, that he was very soon qualified to become a professor; he resided some time at Liege, and was allowed a salary by the bishop, for whom he annually calculated an ephemeris, adapted to the meridian of Antwerp, beginning from the year 1554. The ephemerides of Stadius were much used by the celebrated Dutch mathematician Stevin, though they were afterwards proved to be in many respects inaccurate. From Louvain, Stadius went to Savoy, with a commission as mathematician to the king of Spain, and he removed thence to Bruges, in Flanders, where he composed his "*Falti Romanorum*," which were published by Hubert Goltzius, whose daughter was married to his son; after this he was invited to France as professor royal of mathematics, and lived there in high respect and honour till he became enthusiastically attached to judicial astrology, and on the faith of that pretended art he began to predict future events. He died in the year 1579, in the fifty-second year of his age. He is author of some astrological treatises, and translated a work of Hermes Trismegistus, entitled "*Jatro-mathematicæ, ad Amonem Ægyptium conscripta*."

STADL, in *Geography*, a town of the duchy of Stiria; 8 miles N.E. of Gratz.

STADLİN, or STADLAU, a town of Silesia, in the principality of Breslau, on the Stober; 27 miles E. of Breslau.

STADLKIRK, a town of Austria; 4 miles N. of Steyr.

STADMANIA, in *Botany*, so named by Lamarck, in commemoration of a botanical traveller, M. Stadman, to whom he was obliged for the knowledge of the plant.—Lamarck *Illustr. t. 312*. Poiret in *Lam. Dict. v. 7. 376*.—Class and order, *Ötandria Monogynia*. Nat. Ord. *Sapindi*, Juss.

Gen. Ch. *Cal.* Perianth inferior, minute, of one leaf, with five short, oval, rather pointed, teeth. *Cor.* none. *Stam.* Filaments eight, thread-shaped, erect, rather longer than the calyx; anthers terminal, roundish. *Pist.* Germen superior, oblong; style very short; stigma triangular. *Peric.* Berry dry, globose, generally attended by the rudiments of another abortive one. *Seed* solitary, globose, large.

Ess. Ch. Calyx with five teeth. Corolla none. Stigma nearly sessile. Berry dry, with one seed.

1. *S. oppositifolia*.—Native of the island of Mauritius, where the French call it *Bois de fer*, or Iron-wood, from the hardness of the wood, which is employed for many useful purposes. The half-ripe berries, preserved in a moist form with sugar, are said to be tolerably good.—The tree is large and handsome, with a tall erect trunk, and spreading, opposite, round branches, of a greyish hue, downy when young. Poiret describes the leaves as simple, opposite, stalked, elliptic-lanceolate, coriaceous, perfectly entire, obtuse, slightly contracted at their base, smooth; shining above; paler and brownish beneath; their length three or four inches, breadth an inch, or inch and half. Footstalks three lines long. Flowers about the ends of the branches, in long, stalked clusters, with short, thick, often aggregate, partial stalks, having a small tuberculated permanent bractea at the base of each.—Such is Poiret's account; but Lamarck's plate evidently represents the leaves as alternate, pinnate, of from three to six pair of opposite leaflets; the

clusters of flowers being axillary. Such we believe to be the true nature of the plant. We have specimens brought by Commerçon from the isles of Mauritius and Bourbon, and marked *Bois des Gaulettes*, a name which does not occur in Jussieu, which, if not the same species, have every appearance of belonging to this genus. In these the leaves are alternate, abruptly pinnate, their common footstalks slightly winged. The flowers are in short, dense, compound, axillary, silky clusters. *Calyx* and *germen* very silky. *Fruit* nearly smooth, crowned with the permanent style and stigma. We dare hardly suspect so much inaccuracy of description in the authors cited as to take this for their very identical *Stadmania*, but that it belongs to the same genus there can scarcely be any doubt. We find here and there even the appearance of a bud, or abortive leaflet, at the end of the common footstalk, as represented more strongly by Lamarck, which perhaps led Poiret to take the compound leaf for a branch.

STADT-AM-HOF, in *Geography*, a town of Lower Bavaria, on the Danube, opposite to Ratibon, and connected with it by a bridge. It has two convents and an alms-house, to the latter of which Lutherans and Roman Catholics are equally admissible; the objects of relief, as well as the governors, being half Lutherans and half Catholics; its yearly revenue is said to amount to 80,000 florins.

STADTBERG, or MARSBERG, a town of the duchy of Westphalia, on the Dimel; 20 miles S. of Paderborn.

STADTHAGEN, a town of Westphalia, in the county of Schauenburg, endowed in the 13th century with considerable privileges, and surrounded with ditches, ramparts, walls, and towers. From its sufferings during the 30 years' war, it has not yet recovered. The palace of the prince of Schauenburg-Lippe is in this town, and the gardens have a mineral spring; 8 miles E. of Minden. N. lat. 52° 18'. E. long. 9° 20'.

STADTHOLDER, STADTHOULDER, or *Stadholder*, a governor or lieutenant of a province, in the United Netherlands, particularly that of Holland, where the word (now indeed almost obsolete) has been most used, by reason of the superior importance of the government of that province.

Menage derives the word from *stad*, *state*; and *boulder*, *holding*, *q. d.* lieutenant of the states. Others will have it compounded of *stad*, or *stede*, *stead*, or *place*; and *boulder*, *holding*; in regard this officer held the place of the counts, and represented them in their absence.

The stadtholder, *i. e.* the stadtholder of Holland, was the first member of the republic: he was chief of all the courts of justice, and might preside therein when he pleased. All sentences, judgments, &c. were dispatched in his name. When an office became vacant in any of the courts, the states proposed three persons to the stadtholder, who chose one of them. He even pardoned criminals, which is a sovereign prerogative: and he had the choice of scabines, or chief magistrates, in each city; to which end the council of the city always presented him two persons, one of whom he appointed.

In several cities he had the same right of nominating the burgo-masters and counsellors; as at Rotterdam, Dort, &c. He had also a power to cashier the magistrates, and put others in their room, when he found it necessary for the public good, upon giving a reason for the same.

By article VI. of the union of Utrecht, the States constituted him arbiter of all the differences that might arise between the states of the several provinces, or between the cities and the members of the states of the province.

To the dignity of stadtholder was inseparably annexed that

that of captain and admiral-general of the province; in which quality he named all the officers, and disposed of all military posts. He took care of the execution of the ordinances of the states; and his authority gave him a right to receive, and give audience to ambassadors from foreign princes, and even to send ambassadors on his own private affairs.

The office of stadtholder was very ancient: the counts, not being able to reside in Holland, appointed stadtholders to command in their absence in the several provinces; besides a governor-general of all the seventeen provinces of the Netherlands.

William I., prince of Orange, was made stadtholder of Holland and Zealand in 1576, and soon after of the provinces of Guelders, Utrecht, and Overysel, at the time when the Dutch shook off the Spanish yoke; which enabled him to contribute greatly to that happy event.

In 1584, when William I. was assassinated, the same dignity was conferred, by the same provinces, on his son prince Maurice, who was succeeded by his brother Frederic-Henry in 1625. Upon his death, in 1647, his son, William II., became stadtholder, and he possessed this dignity till his death in 1650. The ambitious views of this prince having given offence to the provinces of the republic, they took measures to reduce the authority of the stadtholder; and the province of Holland formed a design of excluding his son, William III. prince of Orange, afterwards king of England, from the dignity possessed by his ancestors. However, in 1672, Holland, alarmed at the progress of Lewis XIV., declared William stadtholder, and captain-general of the forces of the republic, with the same power which his predecessors had enjoyed. Their example was followed by four other provinces; and, in 1674, on account of his signal services to the states of Holland, they declared him hereditary stadtholder, and determined that his dignity should descend to his male heirs. He was succeeded by his appointed heir, the prince of Nassau-Dietz, hereditary stadtholder of the provinces of Friesland and Groningen, from whom the dignity descended to his son, William-Charles-Henry-Frison. In 1722 he was named stadtholder by the province of Guelderland.

In 1747, the stadtholdership was extended to all the seven united provinces, and made hereditary in the male and female representatives of the family of Orange. For other particulars respecting the change of government, &c. see HOLLAND and UNITED PROVINCES.

STADTKYLL, or STATKYL, in *Geography*, a town of France, in the department of the Roer, on the Kyll; 8 miles N.N.W. of Gerolstein.

STADTLAND, a small island in the North Atlantic sea, near the coast of Norway. N. lat. 62° 10'. E. long. 5° 50'.

STADT-LOEN, a town of Germany, in the bishopric of Munster; 23 miles W. of Munster. N. lat. 52° 6'. E. long. 6° 54'.

STADT-OLDENDORF, a town of the principality of Wolfenbittel, containing about 200 houses; 15 miles W.N.W. of Einbeck.

STADTSBUGDEN, a town of Norway, in the province of Drontheim; 10 miles N.N.W. of Drontheim.

STADT-STEINACH, a town of Bavaria, in the bishopric of Bamberg; 7 miles N.E. of Culmbach.

STÆBIS, in *Botany*, a name given by the modern Greeks to a plant growing very plentifully in the island of Crete, and seeming to be the same with the *stabe* of the ancient Greeks, when used as the name of the pheos or hippopheos; for the ancients used it also as the name of a

low plant of the gnaphalium kind, growing in marshy places, with which they used to stuff beds, &c.

STÆBIUM, a name given by the modern Greeks to the plant called *hippopheos* by Dioscorides: that author also sometimes called it *stabe*.

STÆBROECK, in *Geography*, a town of Guiana, on the east coast of the river Demarari.

STÆCHAS, in *Botany*. See CASSIDONY.

STÆHELINA, appears to have been a name of Haller's, which Linnaeus removed to the present genus. There have been several Swiss botanists, authors of inaugural dissertations, or other small treatises not generally current, of the name of Stæhelin, or Stehelin. Haller seems to have intended principally to commemorate his beloved and regretted friend and companion, Benedict Stæhelin, to whom he addresses two epistles among his poems. (See his *Biblioth. Botanica*, v. 2. 175, and *Hist. Stirp. Helvet.* v. 1. 136.) In the latter place he contends that he had given this name to the *Barbisa alpina*, before Linnaeus dedicated that genus to his own, no less tenderly lamented, friend Bartsch. (See *Fl. Succ.* ed. 2. 211.) However the right of priority may be circumstanced, the *Barbisa* of Linnaeus, like his *Stabelina*, has prevailed; nor can the warmest admirer of Haller or of Stæhelin now regret, that the latter has obtained a most elegant and remarkable genus, of the compound tribe; he having particularly written upon that order, in a dissertation published at Basil in 1721, after the distinguished example of Vaillant, of whom he had been a favourite disciple.—Linn. Gen. 415. Schreb. 546. Willd. Sp. Pl. v. 3. 1783. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 4. 512. Sm. Pl. Ic. 71. Prodr. Fl. Græc. Sibth. v. 2. 162. Juss. 175. Gærtn. v. 2. 412. (Serratula; Lamarck Illustr. t. 666. f. 3, 4.)—Class and order, *Syngnesia Polygamia-aqualis*. Nat. Ord. *Compositæ discoidea*, Linn. *Cinarocephala*, Juss.

Gen. Ch. *Common Calyx* oblong, cylindrical, slightly swelling, imbricated with lanceolate erect scales, each terminated by a small, short, coloured scale. *Cor.* compound, uniform, tubular: all the florets equal, perfect, of one funnel-shaped petal, whose limb is bell-shaped, in five equal, acute segments. *Stam.* Filaments in each floret five, capillary; anthers united into a cylindrical tube, each of them having two elongated teeth at the base. *Pist.* Germen very short; style thread-shaped; stigmas two, oblong, obtuse, erect. *Peric.* none but the unchanged calyx. *Seeds* solitary, oblong, very short, quadrangular: down branched or cloven, longer than the calyx. *Recept.* flat, covered with very short, permanent, chaffy, branched scales.

Ess. Ch. Receptacle with branched scales. Seed-down branched. Anthers with a pair of threads at the base. Calyx imbricated, rather swelling.

1. *S. dubia*. Rosemary-leaved Stæhelin. Linn. Sp. Pl. 1176. Willd. n. 1. Ait. n. 1. Dickf. Dr. Pl. n. 13. Gerard Gallop. 190. t. 6. (Serratula; Lamarck f. 4. Chamæchrysocome prælongis purpurascensibusque Jaceæ capitulis; Barrel. Ic. t. 406. Stæchas citrina altera inodora; Lob. Ic. 486.)—Leaves sessile, linear, somewhat toothed; downy and white beneath. Seed-down smooth, about twice as long as the nearly cylindrical calyx.—Native of dry open hills and fields, in Spain, Italy, and the south of France. Parkinson appears to have cultivated it, but we have never met with the plant in any garden, nor does it make a figure even in catalogues. The *stem* is shrubby, of humble growth, bushy, with round leafy branches, clothed with close white cottony down; as are also the backs of the very narrow, toothed, slightly revolute leaves, each above an inch long. *Flowers* terminal, erect, either solitary or

somewhat corymbose, making a singularly elegant appearance, even in dried specimens, on account of their partly downy *calyx*, variegated with rose-colour and brown, furnished by the tuft of silvery *seed-down*, intermixed with the long, tubular, crimson *florets*, which are eight or ten in each calyx. The genus of this species was considered doubtful by Linnæus, because the *seed-down* is described by Gerard as simple. It is, however, curiously branched from the base, which, added to the bearded *anthers*, sufficiently establishes the character, though we have not examined the scales of the *receptacle*. The habit, moreover, is well marked, and proves this genus, which some French botanists have scrupled to admit, to be one of the most natural, as it unquestionably is the most elegant, of the syngeneis family in Europe. Willdenow has fully altered the specific character for the worse.

2. *S. arborefcens*. Storax-leaved Stæhelina. Linn. Mant. 111. Willd. n. 2. Ait. n. 2. Schreb. Dec. t. 1. Sm. Fl. Græc. Sibth. t. 845, unpublished. (Cyanus arborefcens altera, styracis folio; Alpin. Exot. 33. t. 32. Ciano fruticoso di Candia; Pon. Bald. 165.)—Leaves stalked, elliptical, entire; silky beneath.—Native of rocks on the white mountains of Crete, and in the isles of Hyeres. Miller is said to have cultivated this fine plant, before the hard winter of 1740, which was fatal to so many oriental varieties in the English gardens. The *stem* is woody, two feet high, sometimes an inch in diameter, with round, leafy, silky, ascending branches. *Leaves* remarkably handsome, elliptical or somewhat heart-shaped, obtuse, two or three inches long and half as broad; smooth and dark-green above; white and beautifully silky beneath; with one rib, and many branching veins. *Footstalks* silky, about an inch long. *Flowers* terminal, corymbose, light purple. *Calyx* slightly swelling, its scales roundish-ovate, partly silky. *Anthers* with a double feathery beard. *Seed-down* roughish, cloven in a finger-like manner, like the scales of the *receptacle*.

3. *S. fruticosa*. Smooth Plantain-leaved Stæhelina. Linn. Syst. Nat. ed. 12. v. 2. 538. Willd. n. 3. (Centauræa fruticosa; Linn. Sp. Pl. 1286. Serratula; Lamarck f. 3. Cyanus repens; Lob. Ic. 548.)—Leaves obovato-lanceolate, entire, tapering at the base, smooth on both sides.—Native of Crete and the Levant. Dr. Sibthorp mentions having gathered it on rocks in the island of Chéro, but no specimens are found in his herbarium. The *stem* is shrubby, with round, minutely roughish, branches. *Leaves* near two inches long, dotted, tapering down into a winged footstalk. *Flowers* said to be white. *Calyx* nearly cylindrical, with oblong, acute, partly downy scales. *Seed-down* rough. Its peculiar structure, or that of the scales of the *receptacle*, our specimens will not allow us to ascertain.

4. *S. hastata*. Halberd-leaved Stæhelina. Vahl. Symb. v. 1. 70. Willd. n. 4. (Chrysocoma spatulata; Forsk. Ægypt.-Arab. 147.)—"Stem shrubby. Leaves hastate, hoary, sessile."—Gathered by Forskall near Tæss, in Arabia Felix. A low rigid *shrub*, with numerous, round, hoary *branches*. *Leaves* not half an inch long, very obtuse, dilated into an horizontal lobe at each side; most hoary beneath; tapering at the base. *Flowers* solitary, sessile, towards the extremities of the branches. *Calyx* at first cylindrical, then turbinate, with linear keeled scales. *Seeds* villous; *down* rusty, rather rigid, very finely toothed where it projects beyond the calyx. *Receptacle* scarcely chaffy.—Vahl, from whom we borrow this description, as we have seen no specimen, might possibly not be aware of the true characters of a *Stæhelina*, and therefore might, like Linnæus, Gerard, and others, not observe whether the *seed-down* were branched in this species. Its genus therefore remains doubtful.

5. *S. uniflosculosa*. Simple-flowered Stæhelina. Sm. Prodr. Fl. Græc. Sibth. n. 2016. Fl. Græc. t. 846, unpublished.—Leaves ovate, acute, toothed; downy and snow-white beneath. Stem somewhat shrubby. *Calyx* single-flowered.—Found on mount Parnassus, by Dr. Sibthorp. The *root* of this very pretty species is strong and woody, bearing numerous, partly decumbent, branched, leafy, hoary, shrubby *stems*, about a span high. *Leaves* stalked, an inch or an inch and half long; smooth and dark-green above; very white beneath; their points somewhat reflexed. *Flowers* five or six at the top of each stem, corymbose, erect, small. *Calyx* cylindrical, brown, shining, nearly smooth, half an inch long, containing a solitary, purple, flarry *floret*, with tawny *anthers*, whose base is furnished with a double feathery beard. *Seed-down* cloven in a digitate manner. Nothing can be more certain than the genus of this plant, though its single *floret* forms one of those exceptions in its natural order, which render absolute definitions, in botany, scarcely ever possible.

6. *S. ilicifolia*. Holly-leaved Stæhelina. Linn. Suppi. 358. Willd. n. 5. Sm. Plant. Ic. t. 71.—Leaves opposite, on short stalks, heart-shaped, bluntly toothed; smooth and shining above; woolly beneath. Points of the calyx-scales naked.—Native of New Granada, from whence Mutis sent specimens to Linnæus. The *stem* is shrubby, or arborescent, with round leafy *branches*, downy when young. *Leaves* rather above an inch long, rigid, obtuse, revolute, coarsely toothed, reticulated with veins; of a shining green, as if varnished, on the upper side; densely woolly and white beneath; on short, thick, hoary *stalks*, remarkable for being opposite, those of all the foregoing being alternate. *Stipulas* none. *Panicles* terminal, corymbose, densely woolly, with lanceolate woolly *bracteas*. *Calyx* almost hemispherical, very woolly; its inner scales with smooth, membranous, fringed, finally inflexed, points. *Florets* numerous, yellow; their limb erect. *Anthers* with two points at the base. *Seed-down* rough, or feathery, scarcely branched or digitate. Scales of the *receptacle* short, rigid, with two or three teeth.

7. *S. aquifolia*. Kermes-leaved Stæhelina. (Elichrysum arborefcens, ilicis cocciglandiferæ folio; Plum. Cat. Amer. 9. Ic. 114. t. 123. f. 2.)—Leaves scattered, on short stalks, roundish, abrupt, with spinous teeth; smooth and shining above; woolly beneath. *Calyx*-scales downy throughout.—Gathered in South America by Plumier. This is in many respects nearly akin to the last, though essentially distinct. The *leaves* are but half the size, with finer veins, and sharp spinous teeth. *Flowers* yellow, sessile, either solitary, or several together, at the leafy summit of each branch. *Calyx* longer, and more regularly imbricated, its scales lanceolate, finely and uniformly woolly, without any membranous inflexed points. The *anthers* have two bristly naked points at their base, like the preceding, and the *seed-down* is rough; we cannot perceive it to be branched. We have not been able to examine the *receptacle*. There cannot be the least doubt of this plant belonging to the same genus as the last, and the points in which it differs specifically, serve to bring it nearer to other *Stæhelina*.

8. *S. gnaphalodes*. Soft-linear-leaved Stæhelina. Linn. Sp. Pl. 1176. (Leyfera squarrosa; Thunb. Prodr. 160. Willd. Sp. Pl. v. 3. 2133. Jacea æthiopica, flæchadis citrinæ majoribus tomentosis foliis, capitulorum spinis et squamulis ex aureo colore nitentibus; Pluk. Almagest. 193. t. 302. f. 3.)—Leaves thread-shaped, woolly. *Flowers* solitary, on long stalks. Points of the calyx-scales reflexed, membranous, naked, acute.—Native of the Cape of Good Hope,

Hope, but rare, and as yet a stranger in our greenhouses. The *plant* is shrubby, branched, clothed throughout with white cottony down. *Leaves* an inch and a half to three inches long, very narrow, obtuse, alternate. *Flower-stalks* terminal, solitary, erect, simple, single-flowered, twice as long as the leaves, woolly like them. *Calyx* ovate, of numerous imbricated scales, the inner ones gradually longest, as in the last, all woolly, with shining, tawny or brown, membranous edges, and a strongly reflexed, tapering, almost pungent, smooth point, of the colour and texture of the edges. *Florets* apparently yellow. *Anthers* with two slightly feathery points at the base. *Seed-down* feathery, divided at the base into several palmate portions, like the stamens of a polyadelphous flower. *Scales* of the receptacle crenate, or many-cleft, at the summit.—We know not on what grounds this has been referred to *Leysera*, there being in our specimens no appearance of a radius, nor any thing of the peculiar habit or characters of that genus. But if it were so, this, being the original *Stæbelina*, ought not to be changed. The more particular explanation, than heretofore, which we have given of the rest of the species, answering also to this in so many peculiar and essential characters, will we trust establish the genus before us beyond any possibility of doubt. Plukenet's figure of *S. gnaphalodes*, the only one we can find, though rude, is characteristic, especially in the points of the calyx.

9. *S. spinosa*. Thorny-leaved *Stæbelina*. Vahl Symb. v. 1. 69. Willd. n. 6. (*Chryfocoma mucronata*; Fork. Ægypt-Arab. 147.)—Leaves nearly cylindrical, simple or pinnatifid, with awl-shaped spinous points. Calyx-scales elliptic-lanceolate, erect.—Found by Forskall in Egypt. The *stem* is shrubby, bushy, rigid, with angular branches. *Leaves* also rigid, slender, like branched thorns, an inch or inch and half long, roughish, alternate. *Flowers* terminal, few, somewhat corymbose, yellow, according to Vaillant, who is cited by Vahl. *Calyx* at first cylindrical, then spreading and turbinate, of many, nearly smooth, imbricated, straight scales, each tipped with a scarcely discernible, erect, prickle. *Seeds* hairy, their down very minutely toothed according to Vahl, and the *receptacle* clothed with short bristly scales. We have not seen these parts, nor the *anthers*, so that we cannot be certain of the genus. One of Forskall's specimens, now before us, has decidedly pinnatifid *leaves*.

10. *S. Chamæpeuce*. Pine-leaved *Stæbelina*. Linn. Syst. Nat. ed. 12. v. 2. 538. Willd. n. 7. Ait. n. 3. Sm. Fl. Græc. Sibth. t. 847, unpublished. (*Serratula Chamæpeuce*; Linn. Sp. Pl. 1147. *Chamæpeuce*; Alpin. Exot. 77. t. 76. *Stebe capitata*, overo *Chamepino fruticoso* di Candia; Pon. Bald. 75. *Jacea fruticans*, pini folio; Pluk. Phyt. t. 94. f. 3.)—Leaves linear, crowded, elongated, revolute; downy beneath. *Calyx* ovate. Scales lanceolate, erect.—Native of rocks in Crete and Cyprus, where, as well as in Greece, and on mount Athos, it was gathered by Dr. Sibthorp. Parkinson mentions this species as cultivated here in 1640. It is still preserved in curious greenhouses, and may be seen at Chelsea, flowering all summer long. The *stem* is shrubby, bushy, stout, two or three feet high, its round cottony branches clothed with abundance of long, narrow, drooping, revolute, acute *leaves*; smooth and green above; covered with white cottony down beneath; their base somewhat dilated. *Flowers* forming a sort of spare leafy panicle at the top of each branch, erect. *Calyx* ovate, or nearly globose, bigger than a hazel-nut, of numerous, closely imbricated, lanceolate, acute, downy, crimson-pointed scales. *Flowers* crimson. *Anthers* with a pair of simple, not feathery, bristles. *Seeds* polished, ob-

ovate, variegated with brown; their *down* the length of the calyx, feathery, but not branched or palmate. Scales of the *receptacle* in many bristly segments.

11. *S. ? imbricata*. Imbricated *Stæbelina*. Berg. Cap. 233. Linn. Mant. 2. 281. Willd. n. 8. Thunb. Prodr. 143.—“Leaves ovate, pointed, imbricated; downy beneath. *Calyx* turbinate; its inner scales with reflexed coloured points.—Native of the Cape of Good Hope. The *stem* is shrubby, a span high, with clustered downy branches. *Leaves* sessile, above a line in length; of a glaucous green, nearly smooth, and slightly rugose, above; white and downy underneath; closely imbricated. *Flowers* usually two at the end of each branch, one sessile, the other stalked. *Calyx* downy, of numerous, linear-lanceolate, acute, fringed scales; the inner ones rather the longest, and each tipped with a blueish, chaffy, spreading point, resembling a radiant floret. *Seed-down* simple, minutely feathery, violet-coloured. *Receptacle* naked, rough, with elevated points. Such is the description of Bergius, who mentions no appendages to the *anthers*, nor does the *receptacle*, or the *seed-down*, indicate a *Stæbelina*. Having seen neither specimen nor figure, we must leave the matter undecided.

12. *S. corymbosa*. Corymbose Cape *Stæbelina*. Linn. Suppl. 359. Willd. n. 9. Thunb. Prodr. 143.—Leaves wedge-shaped, toothed; downy beneath. Panicles corymbose. *Calyx*-scales rounded, obtuse.—Native of the Cape of Good Hope. The *stem* is shrubby, with hoary, furrowed, leafy branches. *Leaves* scattered, an inch long, on short stalks, abrupt, toothed at the extremity; green and smooth above; white, finely downy, somewhat silky, beneath. *Flowers* numerous, on angular, downy, corymbose, terminal stalks. *Calyx* not half an inch long, of many broad, brown, downy, erect, closely imbricated scales. *Florets* white or yellowish. *Anthers* with a double spur at the base. *Seed-down* rough, simple, scarcely fasciculated. *Receptacle* small, cellular, not perceptibly scaly. The habit, and the spurred *anthers*, seem to justify us in keeping this species among the *Stæbelinae*, notwithstanding the *receptacle*.

STAFARDA, in *Geography*, a town and abbey of France, in the department of the Stura; 3 miles N. of Saluzzo.

STAFF, BACULUS, an instrument ordinarily used to rest on, in walking. Card. Bona observes, in his treatise of liturgies, that, anciently, those who used a staff in the church to lean on, were obliged to lay it by, and to stand alone, firm and upright, while the Gospel was reading, to testify their respect by their posture; and to shew they were ready to obey Jesus Christ, and to go wheresoever he should command them.

The staff is also frequently used as a kind of natural weapon, both of offence and defence. The Lacedæmonians never wore any swords in the time of peace; but contented themselves with a thick, crooked staff, which was peculiar to them.

Among the Romans, M. St. Evremont observes, blows with a staff were the gentlest correction they gave their slaves; inasmuch as they received them over their clothes. Among the masters of honour and arms, it is held a greater affront to be beaten with a staff than with a sword; because the sword is the instrument of war, the staff the instrument of outrage.

Blows with a staff were very severely punished by the French laws: by a regulation of the marshals of France, in 1653, for reparations and satisfactions of honour, it is adjudged, that a person, who shall strike another with a staff, shall be imprisoned a whole year; unless six months be moderated, upon paying three thousand livres, applicable

to the nearest hospital; beside which, the offender is to ask pardon of the offended on his knees, &c. ready to receive from him a like number of blows with a staff; which, on some occasions, the latter may be obliged to give, if he have too much generosity to do it of himself.

By another regulation of the marshals in 1679, he who strikes with a staff after receiving blows with the fist in the heat of a fray, is condemned to two years' imprisonment; and to four, if he struck first with the fist.

STAFF, A, is used as an instrument for taking accessible or inaccessible heights. For the manner of operation, in taking the height of an accessible object, see **ALTITUDE**.

Inaccessible heights may likewise be taken by means of two staves. This must be done at two stations in a right line from the object, at each of which the staves are to be placed in such a manner, that the summit, or top of the height, may be seen along their tops in the same right line. Thus, suppose *A* (*Plate XIII. Geometry, fig. 17.*) the summit of the object whose height is to be measured, *D E*, *F G*, the two staves at the first station; and *R N*, *K O*, the same staves at the second, so placed, that the points *F D A*, *K N A*, are in the same right line. Through the point *N* let there be drawn the right line *N P*, parallel to *F A*: wherefore in the triangles *K N P*, *K A F*, the angles *K N P*, *K A F*, are equal; also the angle *A K F* is common to both; consequently the remaining angles *K P N*, *K F A*, are equal. And $P N : F A :: K P : K F$. But the triangles *P N L*, *F A S*, are similar; therefore $P N : F A :: N L : S A$. Thence alternately $K P : N L :: K F : S A$; *i. e.* as the excess of the distance of the staves at the second station above their distance at the first, is to the difference of their lengths; so is the distance of the two stations of the shorter staves, to the excess of the height sought above the height of the shorter staff. Wherefore *S A* may be found by the rule of three; to which add the height of the shorter staff, and the sum will give the whole inaccessible height, *A B*.

Staves may be used for measuring any distance: suppose *A B* (*fig. 18.*), to one of whose extremities we have access. Let there be a staff fixed at the point *A*; then going back to some sensible distance, in the same right line, let another be fixed in *C*, so that both the points *A* and *B* may be covered or hid by the staff *C*. Likewise going off in a perpendicular, from the right line *C B*, at the point *A*, let there be placed another staff at *H*: and in the right line *C G K*, perpendicular to the same *C B* at the point *C*, and at such a point of it *K*, that the points *K*, *H*, and *B*, may be in the same right line, let there be fixed a fourth staff. Let these be drawn, or supposed to be drawn, a right line, *H G*, parallel to *C A*. The triangles *K H G*, *H A B*, will be equiangular: wherefore $K G : G H (= C A) :: A H : A B$; *i. e.* as the excess of *C K* above *A H* is to the distance betwixt the first and second staff, so is the distance betwixt the first and third staff to the distance sought. *Tr. Pract. Geom. p. 22—25.*

STAFF, Almucantar's, Augural, Back, Cross, Fore, Pastoral, Whip. See the articles.

STAFF, Jacob's. See **RADIUS Astronomicus.**

STAFF, Quarter. See **QUARTER.**

STAFF, Ward. See **WARD-Staff.**

STAFF-Officers, in *Military Language*, &c. See **OFFICERS.**

STAFF, Field. See **FIELD.**

STAFF, Regimental, consists of the adjutant, quartermaster, chaplain, surgeon, &c.

STAFF, in Heraldry. See **BASTON.**

STAFF, in Music, Riga, Ital., Portée, Fr., the five pa-

rallel lines upon which, and between which, musical characters or notes are written.

Guido Aretin, the great improver of the modern music, is said to be the first who introduced the staff, marking his notes by setting points (.) up and down them, to denote the rise and fall of the voice; and each line and space he marked at the beginning of the staff, with Gregory's seven letters, *a, b, c, d, e, f, g.*

But others will have the artifice of an older date; and Kircher particularly affirms, that in the Jesuits' library at Messina, he found an old Greek MS. book of hymns, above seven hundred years old; in which some hymns were written on a staff of eight lines, marked at the beginning with eight Greek letters. The notes or points were on the lines, but no use was made of the spaces.

The ingenious and learned Dr. Burney has proved that parallel lines were of higher antiquity than the time of Guido. It appears from an ancient MS. treatise on music by Odo the monk, written about the year 920, that lines began to be used in the tenth century. They were eight or nine in number; and at first, the syllables of the psalm or hymn that was to be sung, were placed in the spaces between these lines: after this an alphabetic character was placed at the beginning of each line, capitals for the grave sounds, and minuscules for the acute: to this kind of notation succeeded points, a scale formed of which Dr. Burney has given from a tract written by the great musical monk Hubaldus, who flourished about the year 880. He has also produced three examples from ancient missals, one of which was written about the year 900, cited by P. Martini, in which only one line is used to ascertain the predominant sound of the chant; a red line for the clef of *F*, and a yellow one for that of *C*: and this, he says, seems to have been the first time that a line was drawn through notes of the same elevation, and the origin of clefs, which are only Gothic letters corrupted or disfigured.

Vincenzo Gallilei says, that a little before the time of Guido, the points were placed on seven lines only, without using the spaces; perhaps in imitation of the seven strings of the lyre. The regular staff of four lines was not generally used till the thirteenth century. Kircher, indeed, speaks of Guido's using five lines and five spaces, but, as Dr. Burney says, without authority. However, though lines without spaces, and spaces without lines, had been used before the time of Guido, he seems to have first suggested the use of lines and spaces together; and thus the lines, which by some had been made as numerous as the notes, were reduced to four: a number which, in missals and rituals, of the Romish church, has never since been exceeded. Indeed the use of a line for each note above mentioned, may never have arrived at the knowledge of Guido, who speaks the language of an inventor, with respect to lines and spaces, more than on any other occasion; and, if he be allowed the invention of lines and spaces, clefs will of course accompany them. Burney's *Hist. of Music*, vol. ii. p. 34, &c. p. 87, &c.

STAFF, in a Ship, a light pole erected in different parts of a ship, on which to hoist and display the colours. The principal of these is reared immediately over the stern, to display the ensign; another is fixed on the bowsprit, to extend the jack; three more are erected at the three mast-heads, or formed by their upper ends, to shew the flag or pendant of the respective squadron or division to which the ship belongs.

STAFF, Futtock, or Puttock-staff Rigging, are short pieces of rope, served over with spun-yarn, to which the shrouds are confined at the cat-harpins. Those for the lower and top-mast

top-mast rigging are to be made of iron in future in the navy.

STAFF, in *Rope-Making*, is an implement belonging to the nipper, being an oak bar seven feet long, and four inches square, one end of which is fixed in an iron trap on the upper plate of the nipper, whilst on the other end a weight is suspended, sufficient to press the tar out of the yarn. The "nipper" is formed of two steel plates, eight inches square, and half an inch thick, with a semi-oval hole in each, four inches wide, which, by the upper plate moving, enlarges or contracts, as the tarring of the yarn requires. It is thus fixed: a post, twelve inches square, is placed between the kettle and capstern, with a mortise cut eighteen inches long from the kettle's surface, and five inches wide. The under plate is turned up on each side, to form two grooves, and is let into the front side of the post from the lower part of the mortise: the upper plate has a dove-tail on the back, that slides up and down in a groove into the grooves of the lower plate, and by the staff, made fast to its front, it is elevated or depressed, and regulated by a weight suspended at the other end, so that the yarn receives no more tar than is required, and what is squeezed out drops in a trough, and returns into the kettle.

STAFFS for tops are round, from six to eight feet long, and from two and a half to five inches in diameter, which go through a hole in the top, or are confined under it by a bolt and tails: they run on a truck-wheel, as the rope closes. See *SPINNING-Wheel*.

STAFF, in *Surgery*. See *CATHETER* and *LITHOTOMY*.

STAFF, in *Surveying*, a kind of stand, on which to mount a theodolite, circumferentor, plain table, or the like, for use. It consists of three legs of wood joined together at one end, whereon the instrument is placed; and made peaked at the other, to enter the ground. Its upper end is usually fitted with a ball and socket.

STAFF, *Station*, an instrument consisting of two rulers that slide to ten feet, divided into feet and inches, with a moveable vane or sight, two of which are used with a level; and on the edges there are the links of Gunter's chain divided. Its chief use is for the easy taking off-sets. See *OFFSET Staff*.

STAFF, *Shepherd's*, in *Botany*. See *TEAZEL*.

STAFF-Tree. See *CELASTRUS*.

STAFF, in *Rural Economy*, a measure of nine feet, or half a customary rod. It also signifies the rod set up as a mark in levelling, surveying, &c. See *LEVELLING*.

STAFF and Band Hedge, a term applied to that kind of dead fence of this sort, which is formed and constructed by means of stakes and bands, or edders and eathers.

STAFF, *Churn*, a term applied to the round upright stem, or piece of wood of the staff kind, which, in churning in the old common upright churn, forms the butter from the cream or milk.

A very great and useful improvement has lately been made on the staffs of churms of this kind, by Mr. T. Fisher, an ingenious gunsmith at Ormskirk, in the county of Lancaster; which consists in the head or working part of the staff being formed with a sort of bevil, and its turning upon a swivel made of iron.

The two pieces of wood which form the head of the staff have commonly the following dimensions. Thickness one inch and a half, breadth two inches and a half, length thirteen inches, and from that to any other length, according to the size of the churn. They are joined together in a cross-like manner, by halving one into the other in the middle parts. All the edges on the under side are rounded, or bevilled off to some distance, so as to elevate or raise the

middle part a little above the rest of the head. This cross-formed head is connected with the staff by means of a swivel, which is one inch and three quarters in diameter, being turned perfectly smooth and round. There is a sort of tongue, which is four inches in length from the shoulder, and of an oblong form, which is passed up the staff, and held in its place by an iron peg; the lower round end of which, to the length of about half an inch, serves to steady the head of the staff. And there is a button fixed upon the upper side of the head, which notches into the staff, and keeps it steady in the time of collecting the butter, but when churning, the whole is left perfectly loose. The lower end of the staff, in this case, should be left rather thicker than in the common staff, in order that it may receive the button more perfectly.

STAFF, *Hand*, in *Agriculture*, the name of that part of the common flail which is held in the workman's hand while he is working with it, and to which the couple or other part of the flail is attached. The hand-staffs of flails were formerly mostly connected to the other parts of the tools by means of leather caps and thongs; but the improved method is now by iron caps, made in the manner of round half-circular staples in the middle parts, which connect with and work in the same sort of caps on the couples.

STAFF, *Plough Paddle*, a term sometimes applied to the small staff carried in the body of the plough, which is shod with iron, and employed for clearing away the adhesive earthy matter that hangs about the mould-board, and other parts of common ploughs.

STAFF, *Rack*, that sort of staff which is employed in forming racks for horses or neat cattle.

STAFF, *Tuck*, the name of that sort of staff which is made use of in emptying dung and some other kinds of carts.

STAFFA, in *Geography*, one of the islands of the Hebrides, Scotland, is noted in natural history for its vast basaltic columns and caves. (See *BASALT*.) This small island emerges from the Atlantic ocean, in the midst of a spacious bay, formed by several islands, of which those of Mull, Icolm-Kill, Col, and Tiree, are the chief. In civil government and jurisdiction it is included in the district of Mull, and shire of Argyle, and constitutes part of the parish of Kill-Ninian. It is about five leagues W. from the isle of Mull, and three leagues N.N.E. from Icolm-Kill. The form is oblong and irregular, and the whole extends about one mile in length, and half a mile in breadth, with steep and craggy coasts; its sides are entirely bare, and in many places it exhibits superb basaltic columns, with various caverns. It is accessible only by a small entrance on the west side, where the surface slopes towards the sea; but which will only admit a small boat, and that in calm weather. The most elevated part of the island is over the cave of Fingall, where it is 214 feet above the sea, at ordinary tides. The greatest length of Staffa is about one English mile, and its breadth half a mile. During the summer a few cattle are fed on this island, and are attended by a herdsman and his family, who have a small hut. More than half the circumference of the island is occupied by grand and regular colonnades of basaltes, which are completely exposed to the operations of the sea: the rest of the island exhibits the same basaltic appearances; but the pillars are bent and twisted in various directions; some lying nearly horizontal, and others forming segments of circles. The pillars are chiefly of five or six sides; but some of three, four, or seven. The diameters vary from one foot to four feet and a half: the surface of the large pillars is, in general, uneven; some are jointed, having the upper surface concave, with a correspondent convexity in the inferior; but in many

the surface is plain. The spaces between the perpendicular prisms are filled with a yellow sparry matter, of which the oxyd of iron, separated from the basalt, with some argillaceous earth, and specimens of zeolitic crystals, are the component parts. Near the landing-place the pillars are small, but their magnitude increases in the vicinity of the cave of Fingall. This natural curiosity of the island is 53 feet wide at the entrance, 117 feet in height, and 250 feet in length. The arch is composed of two unequal segments of a circle, which form a natural pediment. The mass by which the roof is crowned, or rather formed, is 20 feet in thickness at its lowest part. It consists of small prisms, inclining in all directions, closely cemented with a calcareous matter, and zeolitic crystallizations, which afford a striking contrast with the dark purple hexagons formed by the ends of the pillars, and exhibit the appearance of mosaic work. The bottom of the cave is filled with the sea. In very calm weather, a boat may sail into it; but if such an attempt should be made when the waves are in the slightest degree agitated, the vessel would be dashed to pieces. The only way of entering at such times is by a causeway on the eastern side, not more than two feet broad, formed by the bases of broken pillars, which being constantly washed by the spray, is very slippery and unsafe. At the further extremity is another small cave, which, from certain passages, emits an agreeable noise every time the water rushes into it, whence it has acquired the name of the "melodious cave." Besides the cave of Fingall, there is another, exhibiting the same appearance, though on a smaller scale. It is situated on the north side of the island, and is called the "Corvorant's cave."

Staffa, though one of the greatest natural curiosities in Europe, or perhaps in the world, has been till lately little noticed, and indeed scarcely known. The first person who particularly called the attention of the learned to this singular isle was Mr. Leach, a native of Ireland; who, in the year 1772, having been on a visit to Morven, in Argyleshire, in a fishing excursion, was charmed with the peculiar appearance of its rocks, and landed upon it. Soon afterwards, sir Joseph Banks, Dr. Von Troil, the learned bishop of Lincœeping, and others, in their voyage from Iceland, anchored in the Sound of Mull; and having been informed by Mr. Leach of the wonders which Staffa afforded, they visited the island, and an account of it was communicated by sir Joseph to Mr. Pennant, who published it in his "Tour to the Hebrides." Since that time it has excited the attention of various naturalists, who have given accounts of it in their respective works: among whom, M. de St. Fond and Dr. Garnett may be principally mentioned. The former, who visited the British dominions on a voyage of research, thus expresses himself respecting Fingall's cave. "This superb monument of a grand subterraneous combustion, the date of which has been lost in the lapse of ages, presents an appearance of order and regularity so wonderful, that it is difficult for the coldest observer not to be singularly astonished by this prodigy, which may be considered as a sort of natural palace. I have seen many ancient volcanoes, and I have given descriptions of several basaltic causeways and delightful caverns in the midst of lavas, but I have never found any thing which comes near to this, or can bear any comparison with it, for the admirable regularity of its columns, the height of the arch, the situation, the form, the elegance of this production of nature, or its resemblance to the master-pieces of art, though art has had no share in its construction." Similar to this are the animated observations of the learned prelate before-mentioned. "How splendid," says he, "do the porticoes of the ancients appear in our eyes, from the often-

tious magnificence of the descriptions we have received of them: and with what admiration are we seized on seeing the colonnades of our modern edifices! But when we behold the cave of Fingall, formed by nature in the isle of Staffa, it is no longer possible to make a comparison, and we are forced to acknowledge that this piece of nature's architecture far surpasses that of the Louvre, that of St. Peter at Rome, all that remains of Palmyra and Pœstum, and all that the genius, taste, and luxury of the Greeks, were ever capable of inventing." In Pennant's *Tour in Scotland*, 4to. 1790, and St. Fond's *Travels*, are accounts of this island, with plates.

STAFFELSTEIN, a town of Bavaria, in the bishopric of Bamberg, on the Lauter; 16 miles N.N.E. of Bamberg. N. lat. 50° 8'. E. long. 11° 3'.

STAFFORA, a river of Italy, which passes by Voghera, and runs into the Po, 8 miles W.S.W. of Pavia.

STAFFORD, a borough, market, and county-town, in the south division of the hundred of Pirehill, Staffordshire, England, is situated on the north bank of the river Sow, at the distance of three miles from its junction with the Trent: and is 16 miles N.W. from Lichfield, and 140 miles in the same direction from London. The earliest authentic mention of the town is in the Saxon chronicle, A.D. 913, when Ethelfleda, countess of Mercia, sister of king Edward the Elder, built a castle here, of which no vestige now remains: and Camden states, that in the following year king Edward built a tower on the north bank of the river. This tower Mr. Pennant supposes to have stood on the mount called Castle-hill, and now distinguished by the appellation of Bully-hill. Near it is an ancient structure, called Castle-church, built in various styles of architecture. Nothing worthy notice is mentioned respecting this town, from the erection of these castles till the Norman conquest, when it appears from the Domesday survey, that the king had here "eighteen burgesses in demesne, and twenty mansions of the honour of the earls." The same record states that the king built a castle here, the custody of which was given to Robert de Toncei, who in consequence took the name of Stafford. This castle does not appear to have stood long; but by whom, or on what account destroyed, is unknown. It was, however, restored in the reign of Edward III., and continued till the seventeenth century; when being garrisoned in support of the royal cause, it was taken by the parliament's forces, and demolished. Stafford appears to have been a town of considerable importance prior to the Norman conquest: early in the tenth century it was considered the chief town of the district: in the Domesday-book it is termed a city, and was at that time governed by two bailiffs: but the earliest charter of incorporation now extant was granted by king John, in the seventh year of his reign. This deed, however, evinces that it was incorporated at a much earlier period; as it merely confirms privileges enjoyed from "remote antiquity," and does not confer any new. The word used in this charter to point out the previous existence of these privileges is *antiquitus*, which certainly would not have been used to denote a period then so recent as that of the Conquest. King John's charter was confirmed by Edward VI., and many new privileges added to the town. Queen Elizabeth established the assizes and sessions here by act of parliament, in the first year of her reign. Mr. Gough states, that in her progress in 1575, she perceived the town to be on the decline; and being informed that it was partly owing to the removal of the assizes, she said she would restore that privilege for ever.

The form of Stafford is that of an irregular ellipsis, the greatest diameter whereof extends from south-east to north-west. The situation, though low, is very pleasant: the streets

Streets are well paved, and the houses in general built of stone, in a compact and regular manner. It anciently had four gates, and was defended, except on the side next the Sow, by a wall, and a ditch supplied with water from the river. When taken by the republican army in 1643, the wall was razed, and the ditch filled up, so that no remains of either can now be discovered. Under the charter of Edward VI. the civil government of Stafford was vested in a mayor, a recorder, ten aldermen, twenty common-councilmen, a town-clerk, and two sergeants at mace. Two representatives are sent to parliament, and have been so ever since the 23d year of Edward I. The right of election is in the mayor and burgesses; the number of voters being about four hundred. The chief manufactures in the town are those of boots, shoes, and cutlery. Tanning is likewise carried on to a considerable extent, as well for the exportation as home consumption of leather. A weekly market is held on Saturdays, and seven fairs, annually. In the year 1811, the population of Stafford was returned to parliament at 4868; the number of houses 885. The immemorial custom of *Borough English* is still retained in this town, whereby the youngest son succeeds to property, as heir at law, in preference to the elder children. Though Stafford may with propriety be considered as only one parish, there are two churches, St. Mary's and St. Chad's. The former is a spacious cruciform structure, consisting of a nave, two side aisles, a transept, and a chancel of three aisles, with an octagonal tower in the centre. This church appears to be of very remote origin: it has, however, been almost entirely rebuilt, but some remains of the ancient structure are still visible. The general style of architecture is the early pointed. The font is a singular remnant of antiquity, very large, and awkwardly constructed. Its height is three feet three inches: the lower part is two feet square; and is ornamented on three sides with human figures lying flat on their faces: on the fourth side is the figure of a ram. Among a variety of monuments, ancient and modern, in this church, those most worthy of notice are, an altar-tomb, in honour of lord Edward Aston, of Tixal, and his wife lady Ann; a monument to the memory of sir Edward Aston, who erected the ancient mansion of Tixal, tem. Hen. VIII. and his lady Joan; and one to lady Barbara Crompton, who, as the inscription informs us, "lyeth interred in the parish-church of St. Gregory, by St. Pauls, London." Near the church, to the westward, formerly stood an ancient building, which Mr. Pennant conjectures to have been the dean's house. The church of St. Mary, anterior to the reformation, was collegiate: king Stephen, at the commencement of his reign, bestowed it on the bishop and chapter of Lichfield and Coventry. At the dissolution, a dean and thirteen prebendaries were attached to it. The other church of Stafford, St. Chad, is a very ancient edifice. Early in the last century it was cased with brick; but some portions of the buttresses of the original building are still visible. St. Chad's parish is of very small extent, not containing more than 20 houses, the rents of which are chiefly paid to the dean and chapter of Lichfield cathedral. Besides the churches, there are places of worship for the Quakers, Independents, Presbyterians, and Methodists, of which sects the two latter are numerous. Of the other public buildings, the most conspicuous are; the county hall, a spacious modern edifice, situated near the centre of the town: it extends a hundred feet in front, and contains many handsome apartments. Behind the hall is a convenient market-place. The county infirmary, a plain building, in the Foregate; erected about the year 1772, according to Mr. Pennant; and supported by voluntary contributions, to

the annual amount of nearly 900*l*. The county gaol, situated opposite to the infirmary; an extensive modern structure, containing about 150 cells or apartments. The free-school, an ancient building, founded and endowed (as appears by an inscription in St. Mary's church) by king Edward VI., in the year 1550. Leland says, "there is a free school for grammar in Stafford, made by sir Thomas Countre, parson of Ingestre, by Heywodde and Syr Randol, a chantry priest of Stafford." Various alms-houses, at different periods, have been built and appropriated for the comfortable accommodation of the aged poor: each tenement has a garden annexed to it. Previous to the dissolution of religious houses, Stafford contained several monastic establishments. At the north end of the walls stood a house of Franciscans, or grey friars, founded, Erdeswick says, by sir James Stafford, of Sandon. King Henry VIII. granted it to James Leveson. A priory of black canons was founded here about the year 1180, and dedicated to St. Thomas á Becket, ten years after his death. Richard Peche, bishop of Lichfield and Coventry, had such a partiality for this house (of which he is by some authors considered the founder), that, resigning his see, he entered himself as one of the members, and so continued the remainder of his life. At the dissolution it was granted to Rowland, bishop of Lichfield. This house, which was situated on the banks of the river Sow, about two miles to the E. of Stafford, was inclosed by a strong stone wall; some remains of the building are still extant. About the middle of the fourteenth century, the Auln friars founded a religious establishment at the southern extremity of the town; a portion of ground having been granted to them by Ralph, lord Stafford, for that purpose. This house was given by queen Mary to Thomas Neve and Giles Isam.

About a mile and a half south-west from the town, on the summit of a hill, are the remains of the castle of the barons of Stafford: the chief portion now standing is the keep, of which each angle is surmounted by a small octangular tower. At a small distance to the south of the castle stood the manor-house, the usual residence of the ancient and powerful family to which this town has given the title of baron, viscount, and earl, from the time of William the Conqueror till the beginning of the last century, when it became extinct; but was again revived in the year 1786, by the elevation of earl Gower to the dignity of marquis of Stafford, which title is now enjoyed by his son, the second marquis. Among the more distinguished natives of this town we find John Stafford, a Franciscan friar, a philosopher and divine of considerable celebrity, born towards the close of the fourteenth century; Thomas Atheburn, an eminent divine of the same century, who distinguished himself as a strenuous opponent of Wickliffe and his new doctrines; Edmund Stafford, bishop of Exeter, and chancellor in the reigns of Richard II. and Henry IV.; Thomas Fitzherbert, a learned and able writer of the sixteenth and seventeenth centuries, who was born in 1552, and died in 1640, in the 88th year of his age.

About three miles west from Stafford, on a lofty mount, is an intrenchment, called Billington Bury. Its area is circular, including several acres, and is surrounded in some parts by one, and in others by two deep ditches. Mr. Pennant considers this fortification as having been originally a British post, subsequently occupied by the Saxons, whose stations have generally the addition of borough or bury.

At the distance of four miles south from Stafford, in the angle formed by the junction of the rivers Sow and Trent, is Tixal Hall, the seat of Thomas Clifford, esq. The present edifice is a plain modern brick building; but in front

of it is an old gateway, ornamented with three series of columns, built by sir Walter Alton. Behind this gateway stood the ancient mansion, of which some remains are still visible, erected by sir Edward Aston, in the beginning of Henry VIII.'s reign. Adjoining to the park which surrounds the mansion is Tixal Heath, distinguished by two remarkable tumuli, one called the King's, the other the Queen's Low. But why so named, or on what occasion constructed, no account is extant. Two urns, supposed to be of Roman workmanship, were found near them early in the last century.

Adjoining Tixal is Ingestre Hall, an old mansion, built in the reign of queen Elizabeth, the seat of earl Talbot. Near the house is the village-church, which was built in 1673, by Walter Chetwynd, esq. the then possessor of this estate.

On Hopton Heath, adjoining Ingestre, a severe action was fought between the parliamentary and king's forces, in the time of the civil wars of Charles I.—History and Antiquities of Staffordshire, &c. by the Rev. Stebbing Shaw, folio, 1798. Beauties of England and Wales, Staffordshire, by J. Nightingale, 8vo.

STAFFORD, a county of Virginia, bounded N. by Prince William county and E. by the Patowmac; containing 9830 inhabitants, of whom 4195 are slaves.—Also, a township of Connecticut, in Tolland county, on the S. line of Mailschuffetts, 12 or 15 miles N.E. of Tolland. In this township is a furnace for casting hollow ware, and a medicinal spring, which is the resort of valetudinarians. It contains 2235 inhabitants.

STAFFORD, *New*, a township of New Jersey, in Monmouth county, adjoining Dover on the S.W. and containing 1239 inhabitants.

STAFFORDSHIRE is an inland county, situated nearly in the centre of England, between 52 and 54 degrees N. latitude, and between one and three degrees W. longitude from London. It is in shape an irregular parallelogram; and is bounded on the N. by Cheshire and Derbyshire, on the E. by Leicestershire, on the S. by the counties of Warwick and Worcester, and on the W. by Shropshire. Its greatest length from N.N.E. to S.S.W. is about 60 miles, and its greatest breadth from E. to W. 38 miles. The superficial contents are about 780,800 acres, of which 100,000 are pasture, 500,000 arable, and the remaining 180,800, woods, waters, wastes, &c.

Ancient State: Historical Events.—This county appertained to the Cornavii of the Britons, to the division of Flavia Cæsariensis of the Romans, and was a part of the kingdom of Mercia during the Saxon heptarchy. Bede calls the inhabitants Angli-Mediterranei, the midland English. The two Roman military ways, Watling-street and Icknield-street, pass through this county. The former enters it out of Warwickshire, near Tamworth, and running westward passes into Shropshire. Icknield-street also enters from Warwickshire at the village of Hansworth, near Birmingham, crosses Watling-street, and enters Derbyshire at Monk's bridge. The Roman stations in this county that are known, are Pennocrucium, near Stretton; and Etocetum, at Wall near Lichfield. But Salmon gives to Staffordshire four Roman stations, which, he says, are Mediolanum, at Knightley; Uriconium, at Wrottesley; Uxacona, at Wall-Lichfield; and Etocetum, at Barbeacon. The first of these stations Camden positively fixes in Montgomeryshire; and bishop Horsley places it on a slip of land inclosed by the Tern and another river. Salmon assigns Pennocrucium to Oldbury, in Warwickshire, and refers to Antoninus's second iter for his authority; but Plot, Gale, Horsley, and Stukeley, coincide in opinion that Penkrige is the site of that

station. The ancient inhabitants of Staffordshire, in the opinion of Dr. Plot, were the Iceni; but in this he stands unsupported: Shaw says that tribe was undoubtedly of Derbyshire. Camden and Gough will not allow that they extended beyond Huntingdonshire, westward; while Salmon confines them to Norfolk and Suffolk. Shaw supposes that the Ordovices were the original inhabitants of this district, and it is generally agreed that they possessed it many centuries before the Christian era. They were an intrepid warlike people, whose territories comprised a great portion of Wales and several counties of England. But they were disturbed in their possessions by the Cornabii, who, breaking through the limits of their original settlements on the banks of the Dee, conquered a large tract of country to the west and north-west, and established a monarchy, of which Condate was the capital. The Brigantes, in their turn subdued a portion of the territories of this tribe a short time previous to the arrival of the Romans. On this event the metropolis was transferred from Condate to Uriconium, now Wroxeter, where it continued a considerable time, till the Romans extended their conquest into the interior of the country. During the sanguinary contests which ensued, little is recorded respecting this district and its inhabitants, but that they heroically resisted the invaders, and though at length compelled to submit, their courage and ardour for freedom excited the admiration of their conquerors. The Cornabii, after the subjection of their country, appear to have been the friends and allies of the Romans. It is remarkable that after the decline of the Roman power, the appellation Cornabii never occurs in the annals of English history. When the Britons experienced a second subjugation by the Saxons, and the heptarchy was established, Staffordshire formed a part of the kingdom of Mercia, which extended over all the midland counties, and was founded by Crida in the year 585. During the repeated invasions of the Danes, this county sustained a considerable part of the calamities consequent on their cruelty and rapacity. Several sanguinary battles took place within the kingdom of Mercia; in Staffordshire particularly, two victories were obtained over the Danes in the reign of Edward the Elder. On the partition of England between Edinund Ironside and Canute, this county, as part of Mercia, was awarded to the latter. After the Norman conquest, William divided the estates of the Mercian earls among four of his principal followers, Hugh de Montgomery, earl of Arundel; Robert de Stafford, Henry de Ferrars, and William Fitz-Ansculph; the last of whom held twenty-five manors in this county. The other principal landholders besides the king, were the bishop of Chester, the abbots of Westminster and Burton, the church of Rheims, and the canons of Stafford and Wolverhampton. During the contention between the royal houses of York and Lancaster, a decisive battle was fought at Bloreheath, in this county, between the Yorkists under the earl of Salisbury, and the Lancastrians under lord Audley, when the latter, with double the force and superior position, was completely defeated, himself slain, and 2400 Cheshire gentlemen, whose attachment to king Henry led them into the van, also fell in the action.

In the civil war of the seventeenth century, Staffordshire was considerably engaged: Stafford surrendered to the parliament's forces, and Lichfield was several times taken and retaken by the contending parties. In this county Charles II. lay concealed after the fatal battle of Worcester, till he had an opportunity of escaping. The circumstances attending his concealment, the difficulties he sustained, and the unshaken loyalty of his friends, are amply detailed by Mr. Shaw in his General History of Staffordshire.

STAFFORDSHIRE.

Ecclesiastical History.—Staffordshire did not receive the light of the gospel till the reign of Penda, king of Mercia, whose son, Peadda, was converted to Christianity by the venerable Bede. This was soon declared the established religion of Mercia, and the cathedral of Lichfield was founded, where the episcopal see of Mercia was fixed in 669; but it was soon afterwards divided into five several dioceses, and Lichfield, Worcester, Hereford, Leicester, and Sidnacester, chosen for the respective sees. In the year 786, at the request of king Offa, pope Adrian advanced Lichfield to the dignity of an archbishopric; but this distinction was continued only till the death of Offa, when pope Leo reduced it to its former rank. About the year 1067 the episcopal seat was removed to Chester, and thence soon afterwards to Coventry, where it continued till the end of the thirteenth century, when Walter de Langton was appointed bishop of Lichfield and Coventry. From this period nothing remarkable occurred in Staffordshire, connected with church history, previous to the reformation, when Lichfield cathedral was despoiled of the rich shrine of St. Chad, and the see of Coventry separated from it. The two bishoprics remained distinct till the restoration, when they were again united in the person of Dr. John Hacket. Since that time the diocese has undergone no particular alteration. Staffordshire, which is comprised in this see, contains 181 parishes.

Civil Division.—Staffordshire is divided into five hundreds; Totmanslow, Pyrehill, Cuddleston, Offlow, and Seisdon: and contains one city, Lichfield, and twenty-three other market-towns, *viz.* Stafford, Wolverhampton, Walsall, Burton-on-Trent, Uttoxeter, Newcastle, Leek, Stone, Cheadle, Eccleshall, Rudgeley, Tamworth, Tutbury, Abbot's-Bromley, Breewood, Penkridge, Cannock, Wednesbury, Burslem, Handley-Green, Lane-End, and Longnor. Ten members are returned to the imperial parliament from this county, *viz.* two for the shire, and two each for Lichfield, Stafford, Newcastle, and Tamworth. According to the population survey of the year 1811, this county contained 57,040 houses, occupied by 295,153 persons; of whom 34,011 families were chiefly employed in trade and manufactures, and 18,361 in agriculture.

General Aspect, Soil, and Climate.—The appearance of the county varies in different districts. The middle and south portions are generally level: among the few exceptions are the hills of Dudley and Sedgely, the quartzose and ragstone hills of Rowley, and those of Clent and Barbeacon. The grounds of Byshbury and Effington, and some situations near Tettenhall and Enville, as well as on Cannock-heath, are also considerably elevated. The latter portion of the county was in ancient times covered with oak, but most of these have been destroyed: indeed scarcely a tree now remains to enliven the prospect, through an extent of 2500 acres. The northern portion of the county is of an opposite character to that on the south. Here the surface is mostly bleak and hilly: only a few of the eminences, however, rise to any remarkable elevation. The summit of Bunter, near Ilam, was found by Mr. Pitt, in the course of his "Agricultural Survey," to be 1200 feet above the level of the Thames. The Weaver hills, and some other points, he reports as ascending even 1500 feet. The general elevation of this district above the southern is estimated at from one to two hundred yards. That portion of it called the moorlands, is the commencement of that range of mountains which extend through the centre of England, till they enter Scotland, acquiring different appellations in their progress, and increasing in altitude as they approach the north. The soil is extremely varied. The arable soils may be divided generally into the argillaceous, or stiff and strong clayey;

the arenaceous, or loose, light, and sandy; the calcareous, or lime earth; and a mixed or compound soil, or loam composed of the foregoing, with the addition of stones and other matters. The climate of this county inclines to wet: the annual rains are calculated at upwards of 36 inches, and thus exceed by nearly 16 inches the average computation of rain in London. A great quantity of snow falls in the moorlands, which doubtless is a principal cause of the piercing cold which prevails in that district.

Rivers.—Staffordshire abounds with rivers, but none of them are navigable, at least within the county. The principal are the Trent, the Dove, the Tame, and the Blythe. The Trent, which may be considered as the third river of England, waters, in its course to the sea, some of the most fertile and best cultivated districts of the kingdom. During its passage through Staffordshire, its banks are covered with luxuriant meadows. In the vicinity of Trent-ham, the seat of the noble family of Gower, the efforts of art have greatly added to the natural beauty of the river, by swelling it into an expansive lake. Passing the town of Stone, it flows through a valley diversified with a variety of elegant parks; of which that of Wolfey, bordering on the chase of Cannock, is one of the most remarkable for the romantic beauty of its scenery. Pursuing its course, the Trent becomes the boundary between the counties of Stafford and Derby, till its junction with the river Dove; then, crossing Derbyshire, it runs through the counties of Nottingham and Lincoln, and at length pours its waters into the Humber. The Dove takes its rise among the hills in the moorlands, near the points where the counties of Stafford, Derby, and Chester meet. From the declivity of its channel, its waters flow with uncommon rapidity: in some places it dashes precipitately over rugged rocks; in others it is distinguished by gentle cascades. It falls into the Trent near Burton, on the confines of Derbyshire. The Tame, another river of considerable size, springs from several sources in the vicinity of Walsall and Colehill, enters Warwickshire near Birmingham, returns into Staffordshire at Tamworth, and finally joins the Trent. The Blythe rises in the neighbourhood of Watley moor, in the northern district. Its course is nearly parallel to the Trent, into which it falls near King's-Bromley.

Canals.—Although an inland situation, without navigable rivers, appears to labour under peculiar disadvantage for the purposes of trade; yet in Staffordshire the deficiency is amply compensated by the number and extent of the canals, with which this county is so largely supplied. The principal are the Grand Trunk Canal, the Coventry and Oxford, and the Birmingham Canal. These, with their numerous branches and ramifications, have already been particularly described. See CANAL.

Lakes and Springs.—This county affords but few lakes, and those of no great consequence. Those most worthy notice are that of Aquilate, which extends 1848 yards in length, and 672 in breadth; and Ladford Pool, which occupies the space of about 60 acres. Salt springs are found in various places. The most considerable are those in the parish of Welton, whence salt is produced, equal in quality and colour to that of any part of the kingdom.

Minerals.—The number and value of the mineral productions of Staffordshire claim particular notice. Coal is abundant: upwards of 50,000 acres have been ascertained to contain an inexhaustible supply, near enough to the surface to be easily raised. From the earliest times to the present, the consumption does not appear to have exceeded a tenth part of the whole. In the southern division of the county, the coal district extends in length from the interior

of Cannock-heath to the vicinity of Stourbridge, and in breadth from Wolverhampton to Walsall. To the north, likewise, it abounds in the neighbourhood of Newcastle and the Potteries, Lane-End, Hollybush, Cheadle, and Dill-horne. At Handley-Green a very peculiar species is dug, called the Peacock coal, from the prismatic colours it displays. Limestone is still more abundant than coal. At Sedgley and Dudley-cattle hills, Rushall and Haywood, and on the north-east moorlands, the quantity is immense. The lime-works upon Caldon Low, and near the Weever hills, are particularly extensive. This stone is, in some places, of a marble quality, and capable of taking a fine polish. In other parts it is chiefly composed of tremitholopi, or petrified marine substances of the animal kind. Iron ore is plentiful throughout the coal district. Near Wednesbury, Tipton, Bilston, and Sedgley, and to the west of Newcastle, it is peculiarly excellent and abundant. The strata are generally ranged beneath a stratum of coal. Iron-works of great extent have been recently established on the banks of the Birmingham Canal; and the trade is so rapidly increasing, as to afford a prospect of its precluding the necessity of any considerable importation. Copper and lead ore also abound in this county. A copper-mine is worked at Mixon, near Leek; but a more important one at Ecton-hill, near Warflow, on the estate of the duke of Devonshire. This hill has likewise a considerable vein of lead; and another of the same mineral has been found near Stanton-moor. In this part of the county, but particularly at Whiston, Oakmoor, and Cheadle, smelting and brass-works are carried on to a considerable extent. Quarries of good free-stone for various purposes are found in the different districts. A durable kind for building, easily raised in blocks of any dimension, is found at Tixal. Alabaſter was formerly dug in great quantities, particularly on the banks of the Dove; but though it still exists in plenty, very few of the quarries are now wrought. This county also yields various kinds of marble: that species, to which the name of rance-marble is given, abounds on Yelpersley Tor, and the adjacent hills. Clays of every denomination are abundant. Amblecot produces a clay of a dark-blue colour, of which are made the best glass-house pots of any in England. Glass-houses have, in consequence, been erected in the neighbourhood; and great quantities of the clay are sent to different parts of the kingdom. Potters' clay of various sorts is found here, particularly in the vicinity of Newcastle, where the potteries are chiefly carried on. Yellow and red ochre, and other earths used for colouring and painting, are among the productions of this county. At Darlaston, near Wednesbury, is a blue clay, which is sold to glovers to dye ash-colour. A black chalk is found in the beds of grey marble in Langley Cloſe; and under a rock near Hemley Hall is a reddish earth, nearly equal to the red chalk of France.

The farms of Staffordshire are of all extents, from fifty acres to five hundred; but the number of the smaller has been lately much diminished. The rent of land varies from 15s. to 40s. per acre, making the average about 25s. The cultivated lands of this county are nearly all inclosed, not more than 1000 acres still remaining open. The fences in the southern part are chiefly raised from quickſets, among which the white thorn is most approved.

Timber, Plantations, and Woodlands.—This county, notwithstanding the great recent consumption, is abundantly stocked with wood of every description. Lord Bagot's estate, near Abbot's-Bromley, contains several acres of oaks, not to be surpassed in quality by any in the kingdom: the timber in many of them is to the height of sixty or

seventy feet. Chillingworth estate ranks next to this for the value of its woods. Those at Beaufort, the seat of the earl of Uxbridge, and those at Llamley, the property of lord Dudley, are also very extensive. Teddesley has very considerable plantations. Mansley wood is a coppice of fine oak. Wrottesley, Fisherwick, Trentham park, Sandwell park, Envile, and Hilton, display abundance of well-grown trees of every description.

Waste Lands.—The extent of uncultivated lands in this county is very great; being computed by Mr. Pitt to amount to an hundred thousand acres. The chief waste districts in the southern parts are Cannock-heath and Sutton-Coldfield, with Swindon, Wombourn, and Fradley commons. In the north are Morredge, Wetley-moor, Stanton-moor, Hollington-heath, Careſwell-common, and Needwood forest; which last, however, has been in part recently inclosed and cultivated.

Manufactures and Commerce.—Various branches of manufacture are carried on to a great extent, particularly in the southern parts of the county: the chief are hardware articles, nails, glass, toys, japanned goods, and potters' ware; with productions in cotton, silk, leather, woollen, and linen. The manufacture of glass is most considerable in the vicinity of Stourbridge, where many spacious glass-houses have been built. The potteries occupy an extent of ten miles, toward the north part of the county: these have acquired great reputation from the ingenious Mr. Wedgewood. (See POTTERIES.) Wolverhampton and the neighbouring villages are distinguished for the manufacture of locks: buckles, steel-toys, and watch-chains, are among the esteemed productions of that town. The staple manufacture of Walsall and its vicinity is chiefly shoe-buckles, clasps, and sadlers' ironmongery. Nail-making, in many country parishes, is a source of employment to great numbers of men, women, and children. Bilston furnishes a variety of plated, lackered, japanned, and enamelled goods. At Wednesbury the gun-trade is extensive. At Darlaston, Willenhall, and the adjacent villages, tobacco and snuff-boxes are wrought in various modes. Stafford and its neighbourhood exhibit numerous articles in the cutlery and leather-trade: the hat manufacture is also carried on there, and in some other towns, on an extensive scale. Tin and brass are among the common productions of the county. The cotton manufactures at Roceſter, Fazeley, Tamworth, Burton, and Tutbury, are very considerable; as is likewise the silk-trade of Leek, and that of tape at Cheadle and Teyn. The woollen manufacture is but comparatively trifling; most of the raw wool being sold into the clothing and stocking districts. The making of linen is mostly confined to private families, for their own use.

It is worthy of observation, that the original wooden almanac of the Norwegians and Danes is still in use in this county, under the appellation of the Staffordshire clogg. Engravings of this calendar, something different from each other, may be seen in Dr. Plot's Natural History of the County, and in Camden's Britannia, by Gough. The principal antiquities in this county are the cathedral at Lichfield; Tutbury castle and church; Dudley castle and priory; Eccleshall castle; Croxton abbey; Alton castle; Wolverhampton church; bridge and abbey, at Burton-upon-Trent; Darlaston castle; Tixal manor-house; Hilton abbey; Rowton priory; Uttoxeter church; Careſwell castle; Chartley castle; Heyley castle.

Authorities.—History, &c. of Staffordshire, by the Rev. S. Shaw, 2 vols. folio, 1798, &c. an unfinished work. General View of the Agriculture of the County of Stafford, by William Pitt, 8vo. 1808. The Natural History

of Staffordshire, by Dr. Plot, fol. 1686. A Map of the County, begun in 1769, and finished in 1775, by William Gates, six sheets. Account of Staffordshire, in the Beauties of England, vol. xiii.

STAFFURTH, a town of Germany, in the principality of Anhalt-Bernburg; 9 miles N.W. of Bernburg.

STAFLEFIT, a town of Prussia; 7 miles S. of Culm.

STAG, or *Red Deer*, or *Hart*, in *Zoology*. See *CERVUS Elaphas*. See also DEER, HART, HUNTING, and SHOT.

STAG, in *Rural Economy*, a term applied provincially to a young horse.

STAG-Beetle, in *Natural History*, is the *LUCANUS Cervus* of Linnæus; which see.

STAG-Evil, or *Hart*, in horses and neat cattle, a kind of universal cramp or convulsion. See HART.

This is a disease with which young horses are not unfrequently affected. It mostly comes on after much exposure to severe cold, or a high degree of cold moisture, where heat takes place suddenly afterwards, and sometimes in cooling too quickly after great heat. It attacks the whole body, but more particularly the joints, with a sort of foreness, rigidity, and stiffness, which cause the animals to move about in a slow, awkward, almost lifeless manner. They gradually fall off in their appetites, and become incapable of performing any kind of labour, and often even the mildest exercise distresses and inconveniences them in a high degree.

In its removal, calomel, with opium and the powder of gum guaiacum, may be first had recourse to in the form of a ball, made up with balsam copaiva, for some days; when the use of warm cordial strengthening drinks or drenches, with oak or Peruvian bark in fine powder, may be found necessary to complete the cure; the horse during the time being made to take as much gentle exercise as possible. And the use of a good dry grass pasture is not unfrequently of great benefit in completing the removal of the disorder.

Neat cattle are likewise frequently subject to a disease of the same nature, which, after much exposure to intense cold, comes on with a stiffness in the joints, which is attended with a lumpy swelling on them and the legs, after a little time, without any inflammatory appearances. This stiffness and foreness sometimes extend over the whole body, so that the beasts become incapable of rising, when down, without assistance. Where the chine or back is particularly affected, the disease is mostly denominated the *chine fellon*; but where the joints have more of the disorder than any other part, it is commonly termed the *joint fellon*, or *joint evil*; and where the whole body is deranged and disordered, it has often the name of *cold fellon* given it.

The disease is particularly liable to attack milch-cows and young cattle in the spring season, being occasioned probably by their being kept through the winter in a low weak state, and suddenly exposed in the spring to the extreme coldness of the north and north-easterly winds, in low damp situations, or other similar places.

In order to remove the disorder, a ball of the same kind as that for horses may be given for some days, until the foreness and stiffness begin to go off, when recourse should be had to such powders or balls as those recommended below, given in a hornful or two of warm ale.

The powder of gum guaiacum, in the quantity of about an ounce, with an ounce and a half of Æthiops mineral, or sulphuretted quicksilver, and two ounces of the grains of paradise, in fine powder: or, camphor in the proportion of about a drachm and a half, rubbed with a few drops of the spirit of wine, to which may be added guaiacum and Peruvian bark in fine powder, of each about an ounce and a

half, warm feeds in powder three ounces, and treacle or honey two or three ounces, to form a sort of ball.

The drinks of this sort may be continued occasionally for some time. And much utility may at first be derived from the use of a comfortable house of some kind or other for containing the animals, and afterwards by their being turned into dry warm pastures, when the season admits.

The rubbing of the swellings in the joints with strong camphorated turpentine embrocations, as frequently practised, is mostly improper, sometimes injurious, and always hazardous.

Where the disease changes to, or puts on the appearance of a more inflammatory nature, as that of the acute rheumatic kind, with fever, pain, and tumefaction of or about the joints, it may be on some occasions necessary to resort to remedies of the camphor kind, with calomel, and a small proportion of opium, giving at the same time some sort of active opening or purging medicines. The above cordial strengthening bark-powdery remedy will afterwards, for the most part, be of great utility.

STAG-Horn Tree, in *Gardening*. See RHUS.

STAG-Worms, in *Natural History*, a name given to a species of worms produced from the eggs of a fly, and lodged in a very strange place behind, and under the palate of the stag, or deer's mouth.

They are always found in great numbers together, and are contained in fleshy bags, which are placed as the almonds of the ears in the human species. The huntsmen are well acquainted with these worms, and are of opinion that they are the cause of the falling off of the creature's horns; they eat their way to these, according to their opinion, through the proper parts of the head, and then gnawing them round at the roots, they are forced to fall, like a tree that is sawed off at the bottom. This, however, is a vulgar error.

M. Reaumur has abundantly proved, that these worms never attempt so strange a passage; they always remain where they are first found till they are in a state to change into the flies to whose eggs they owe their origin, and whose forms they are at length to assume. Reaumur's Hist. Inf. vol. ix. p. 8.

STAGE, in the *Modern Drama*, the place of action and representation; included between the pit and the scenes.

The stage answers to the proscenium or pulpitum of the ancient theatre.

For an account of the English stage, see MYSTERY, PLAYHOUSE, and SCENE. See also *DRAMATIC Machinery*, and SCENOGRAPHY.

Unlicensed stage-plays are deemed public nuisances, and may, upon indictment, be suppressed and fined.

STAGE, *Laws of the*, are the rules and decorums to be observed, with regard to the economy and conduct of a dramatic performance to be exhibited on the stage. These relate, principally, to the unities, the disposition of the acts and scenes, the unravelling, &c.

STAGE also denotes a certain distance to which stuff is to be wheeled, at stated prices *per cubic yard*: the usual stage is an interval of 20 yards; but on very steep or quite level wheeling, they are sometimes reckoned 15 yards, and in other cases 25 yards.

STAGE Island, in *Geography*, a small American island, near the coast of Maine, not far from Casco bay, remarkable for being the first land inhabited by Europeans in New England. It is not now uninhabited.

STAGEBORG, a town of Sweden, in East Gothland; 15 miles S.E. of Nordkiöping.

STAGGARD, among *Sportsmen*, a male deer only four years old.

STAGGERS.

STAGGERS, among *Farrriers*, a disease of horses, which has sometimes been denominated *apoplexy* (which see), and which consists of a giddiness in the head, and which, in some cases, is indicated by madness. Of this disease authors have described two species; *viz.* the *sleepy*, and the *mad* staggers. In the first species, the animal becomes inactive, and manifests a heaviness of the eyes, and an inclination to sleep, the head resting in the manger; accompanied with costiveness, and other symptoms of fever. In the second sort of staggers, the horse, without indicating any previous signs of disease, falls down apparently deprived of all voluntary motion, with the eyes insensible to light, the breathing difficult, a great motion of the flanks, and a quick, full pulse. In the mad staggers the horse often rises, plunges violently in the stable, and again falls down in an insensible state.

This disease is frequently occasioned by turning out a horse to graze too soon, before he is well cold: where, by hanging down his head to feed, humours are generated, which oppressing the brain, are the proximate cause of this disease. Sometimes it comes by over-exercise in hot weather, which inflames the blood, &c. sometimes by noisome smells in the stable, excessive eating, &c. the rupture of a blood-vessel, or external injuries on the head.

The signs of it are, dimness of sight, reeling, and staggering, watery eyes, &c. At length, through extreme pain, he beats his head against the wall, thrusts it into the litter, rises and lies down with fury, &c.

The most approved remedy for this distemper is derived from the following treatment. Begin with copious bleeding from a large orifice in the neck-vein, and repeat the operation, if the strength of the horse admit of it, and the symptoms of the disease require it. After bleeding administer a ball, prepared of two drachms of calomel, an ounce of Barbadoes aloes in powder, two drachms of ginger, and a sufficient quantity of honey. Apply also a glyster, prepared by mixing three quarts of oatmeal gruel, three ounces of common salt, and half a pint of olive oil. If the disease continue after this treatment, put a rowel under the jaw, and another in the chest; applying also, behind the ear, some blistering liniment: let the horse be supported at the same time by mashes, or if he refuse these, by gruel in the quantity of two or three quarts, frequently given. After opening the bowels sufficiently, let the following fever-powder be given: *viz.* one drachm of pulverized camphor, a scruple of antimonial powder, and six drachms of powdered nitre, all well mixed. When the symptoms are relieved, mashes of bran or oatmeal may be occasionally given, with a small quantity of corn: hay should be sparingly allowed. Omit the powders, and give the following restorative ball every morning, till the horse recovers strength, taking care to keep his bowels open by mashes: the ball is prepared of Peruvian bark and gentian, in powder, of each $\frac{1}{2}$ th of an ounce; two drachms of ginger, one drachm of vitriolated iron, and a sufficient quantity of honey. The rowel under the jaw should be continued at least a fortnight after the disease has been removed. Attention should afterwards be observed with regard to the kind or quantity of food, the exercise and stable treatment.

Horses are subject to convulsions and staggers, arising from a retention of the dung and aliment; which are indicated by swollen eyes, reeling and tottering motion, short breath and cough, and irregular motion of the flanks; aversion from lying down, costiveness, indisposition to stand, and dark-coloured urine; and sometimes jaundice. Gibbon directs the dung to be raked up by the hand from the rectum, which dung is generally hard, in small balls of

a blackish colour, without moisture. After this operation, administer plenty of emollient oily glysters of marshmallows, or pot liquor, water gruel or water; adding to three pints or two quarts of the liquor a pint of linseed-oil, and half a pound of treacle; which should be given milk-warm, and repeated every day, till the dung comes away with ease, and in a soft state: accompanying this medical treatment with diet of the best hay, scalded bran or chaff, or boiled barley. When the dung comes away with facility, and in great abundance, the following gentle lenitive purge may be given; *viz.* lenitive electuary and cream of tartar, of each four ounces, and two ounces of common sugar, mixed in a pint and half of hot ale; to which, when the tartar is dissolved, add the sugar, and last of all the lenitive electuary. Let this be given in the morning, upon an empty stomach, blood-warm; and repeated three or four times, with a respite of two or three days between the draughts, keeping the horse to an opening diet, with proper exercise, till he recovers his usual vigour.

Mr. Boyle mentions a cure of this disease in horses, by rubbing their gums with the coach-whip till they bleed. Works, Abr. vol. i. p. 88.

STAGGERS, a disease in sheep, in which they are mostly considered as extremely liable to move or turn themselves about in a quick manner.

The remedy for this disorder was formerly to drive them to a change of grounds often, to keep the grounds from tainting. And it has been noticed by Lisle, that those lambs which die of the staggers do not die till they begin to eat grass, and of those the finest and lustiest; whence he concludes, that it is not the cold weather alone that brings staggers, but their feeding on cold watery grass in the months of March and April. The disease was much prevented by the early folding of the lambs. See *GID*.

The disease mostly appears in the autumn, and is said to be produced by a variety of causes; such as improper food, the leaves of the oak-tree, on account of their astringent quality, cobwebs besprinkled with dew, and different others. And it probably often proceeds from local affections, and water in the brain. Some have likewise supposed that it arises from the operation of a poisonous grass, the *lolium temulentum*, which is alone met with in those situations of Scotland where the staggers in sheep prevail. But what effect such cases have on the brain, to produce or cause such a disease, is not pretended to be explained.

Where this disease continues for any length of time in the same sheep, it is liable to become fatal.

The change of pasture is supposed to be the only effectual remedy in such cases, but the use of calomel and bark may often be found of material advantage, as well as other means which have a tendency to remove water from the brain.

STAGGERS is also a disease in neat cattle, which is often very troublesome and unpleasant in its consequences and management. The principal seats of the disorder would seem to be the head and the stomach, which naturally sympathize with each other. It may proceed from a variety of different causes, as improper and insufficient feeding, too much exposure to cold, drinking too largely of very cold water, under particular circumstances, water and local affections of different kinds in the brain and parts about it, and many others of the same nature.

It is most liable to attack such cattle as have been poorly fed, or starved in the winter season, on their being first turned out upon good pastures in the early spring; but it not unfrequently happens to other cattle which have been regularly fed. It likewise occurs in very different states and

degrees of violence, according to the circumstances and habits of body of the animals. And it occasionally takes place in calves, and other young flock of this sort.

The disease shews itself by the reeling, wavering, staggering, and imperfect gait of the animal; by the heavy, dull, and sluggish motion and appearance of it; and an inclination to become drowsy, and the resting or reclining of the head upon any convenient place near it.

It sometimes, however, puts on a more local inflammatory appearance, in which cases the beasts have commonly a less heavy drowsy disposition, with more of the wild raving or raging tendency and quality in their aspects and dispositions.

In the former of these states, the disease may be attempted to be removed by the giving of calomel in pretty large doses, as a drachm or more to a large beast, two or three times in the course of the week, and powders composed of camphor rubbed with a few drops of spirit of wine, in the quantity of about two drachms. Common nitre, or saltpetre in powder, two ounces and a half; and the roots of rhubarb in powder, or some other similar matter, from one to two ounces and upwards, in the intervals between the doses of calomel. The beast, during the time, should be kept moderately warm, and have good hay and warm mashes occasionally given to it, preserving it as much as possible in a temperate state in every respect.

In the latter state it may sometimes be necessary to take away blood in proportion to the size and strength of the beasts, as from one to two or three quarts; after which, the bowels may be well opened by the use of pretty strong purgatives of the saline kind; then, where there is much fever of the inflammatory kind attending the disease, a ball composed of tartarized antimony, in the quantity of from half to a whole drachm, with about two drachms of camphor rubbed as above, and from a drachm and a half to two drachms of prepared ammonia in powder, made up with a little treacle, may be given in a hornful or two of warm oatmeal gruel, once or oftener in the day to the beasts, until it disappears. In tedious cases of this sort, with much affection of the head, great relief may sometimes be gained by the application of strong blisters about the head, or the rubbing of the parts near and upon it, and on the sides of the neck, with strong ointment of the blistering kind, after the hair has been well clipped off and removed from them.

Afterwards it will only be necessary to let the beasts have a strengthening cordial drink or two, and the use of a good dry pasture, when the season will admit of it.

STAGGERWORT, in *Agriculture*. See RAGWORT.

STAGIRA, or STAGIRUS, in *Ancient Geography*, a town of Macedonia, in the vicinity of mount Athos, upon the Strymonic gulf, between Amphipolis on the north, and Acanthus on the south. This town was the native place of Aristotle, hence called the Stagirite.

STAGNANT *Watery Land*. See WATERY *Land*.

STAGNO, in *Geography*, a sea-port town of the republic of Ragusa, on the Adriatic, the see of a bishop, suffragan of Ragusa: about a mile from the town is a fortress, called "Stagno Piccolo," or Little Stagno; 30 miles N.W. of Ragusa. N. lat. 43° 30'. E. long. 17° 59'.

STAGONIAS, a word used by the old authors to express that sort of male frankincense which is in round drops, and very clear and fine.

STAGONIUS, a name sometimes given to storax.

STAGS, in *Geography*. Several rocks on the coast of Ireland are so called; as, the Stags on the south-east entrance of Cork harbour, near Roches tower, where a light-

house is erecting; the Stags of Castlehaven, south of Toehed, county of Cork; and the Stags of Broadhaven, north of Binwy-head, on the Mayo coast.

STAHL, GEORGE ERNEST, in *Biography*, a celebrated physician and chemist, was born at Anspach, in Franconia, in October 1660. He studied medicine at the university of Jena, and laid the foundation of his fame, immediately after his graduation in 1684, by commencing a course of private lectures among the students of that place. His advancing reputation procured for him the appointment of physician in ordinary to the duke of Saxe-Weimar in 1687. On the establishment of the university at Halle, in 1694, Frederic Hoffmann, with his accustomed liberality, solicited the appointment of a medical professorship for Stahl, who accepted the office, and became the rival of that distinguished physician as a teacher of medical systems, but not in the exercise of candour and liberality towards his colleagues. Stahl was conscious of possessing considerable mental powers, and paid little respect to the opinions of others; and he became the leader of a sect or school of physicians, in opposition to the mechanical theorists, in which he was followed by many eminent persons, not only in Germany, but in other countries, as by Perrault in France, Gaubius in Holland, Porterfield and Simpson in Scotland, and by Nichols and Mead in England, notwithstanding the very fanciful nature of the hypothesis on which his system was founded. The "Conspectus Medicinæ" of Juncker was published to illustrate his doctrines in Germany; and a succinct account of the system was given by Dr. Nichols, in his work "De Animâ Medicâ," in this country.

Physicians had always remarked a certain power in the animal body of resisting injuries and correcting some of its disorders, which they had called *nature*, and *vis medicatrix nature*, and Van Helmont had already ascribed some degree of intelligence to this power. But it remained for Stahl to refer this power entirely to the *rational soul*, which, he affirmed, not only originally formed the body, but is the sole cause of its motions, in the constant excitement of which life consists. For he maintained that the soul abhors the dissolution of its body, and therefore excites and directs all its motions, the vital and involuntary as well as the voluntary motions, to prevent that dissolution, by obviating putrefaction, and expelling the corrupted humours by various appropriate organs or excretories; in a word, that all the functions of the body are entirely directed by the mind, which intelligently perceives the tendency of all impressions, external and internal, made upon the body, and excites such motions as may favour the beneficial, and obviate the injurious influence of all causes acting upon it. Whence he farther contended, that diseases, such as fevers and spasmodic affections, were in fact the motions voluntarily excited by the rational soul, for the purpose of opening emunctories, and expelling some offending cause. Generally speaking, therefore, it was maintained, that diseases were salutary efforts of the presiding soul, and were to be assailed, and not interrupted, by the interference of art: yet it was somehow admitted, that the mind, from surprise, fear, or despair, occasioned by too sudden or vehement impressions made upon it, occasionally excited adverse motions, which it was right to moderate. Independently of the visionary character of this hypothesis, it was justly deprecated as leading physicians to neglect the use of remedies, or to use only the most inert and frivolous ones; and also to set little value upon the collateral studies of medical science, even upon anatomical researches, which Stahl maintained had little or no reference to the art of healing. And, in fact, both he and his followers, trusting principally to the attention and wisdom of nature,

nature, adopted that inactive mode of *curing by expectation*, la médecine expectante, as the French have called it; they zealously opposed the use of some of the most efficacious remedies, such as opium, cinchona, and mercury; and were extremely reserved, even in the use of general evacuations, such as bleeding, vomiting, &c. although their system led them to refer almost all the disturbances of the motions of the system to a plethora, or too great abundance of the blood. This hypothesis was maintained by Stahl in several publications, with much ability and ingenuity; and it continued to influence a great number of intelligent physicians for a long time. His principal medical work, in which his system is displayed in its most matured form, is entitled "Theoria Medica vera, Physiologiam et Pathologiam sistens," printed at Halle in 1708.

The merits of Stahl as a chemical philosopher are of a much higher character; and the school which he founded in this science, after extending its influence long and universally among those who pursued the same inquiries, has only been superseded of late by farther discoveries. He was the inventor of the celebrated theory of *phlogiston*, which appeared to explain the phenomena of combustion and inflammability, and was received every where with high applause, and which, in fact, occasioned Germany to become the great school of chemistry. It cannot be denied, indeed, although later experiments have subverted the groundwork, that this hypothesis tended greatly to simplify the ideas, and perfect the operations of chemists, and entitled its author to a high rank amongst the improvers of science. His principal chemical work was entitled, "Fundamenta Chymicæ dogmaticæ et experimentalis," first printed in 1729, and several times reprinted: but before that period he had published several other works on this subject, such as "Disertationes de Metallurgiæ et Docimastiæ Fundamentis," 1697; and, in the same year, "Experimenta et Observationes 300 Chymicæ et Physicæ," in which work he principally advanced his doctrine of phlogiston. He also published in the German language some essays "On Sulphur," and "On Salts."

Stahl was elected a member of the Academy Naturæ Curiosorum in 1700. He was called to visit Frederic William, king of Prussia, at Berlin, in 1716; and afterwards returned several times to that capital, where his reputation was very high, and where at length he was attacked with a fatal disease, in 1734, in the seventy-fourth year of his age. See ELOY Dict. Hist. de la Médecine. Gen. Biog. Cullen's First Lines. Pref. And Hoffmann's essay, "De Differentiâ Doctrinæ Stahlianæ et Hoffmannianæ."

STAIIDENFELD, in *Geography*, a town of the duchy of Wurzburg; 4 miles S. of Schweinfurt.

STAIN, a town of the county of Tyrol; 2 miles S.W. of Meran.—Also, a town of Austria, on the Danube, consisting almost wholly of one street, and containing two churches. It is near Crems, and governed by the same magistrates. It is joined by a long bridge with Mautern, on the other side of the Danube; 32 miles W.N.W. of Vienna.—Also, a town of Austria; 2 miles N. of Steyr.

STAIN. See **STEIN**.

STAINABRUNN, a town of Austria; 6 miles W.S.W. of Ehrnsprunn.

STAINBACH, a town of Austria, on the Teichel; 6 miles S. of Steyr.

STAINER, JACOB, in *Biography*, a German maker of violins of the most sprightly and brilliant tone. His signature, pasted on the inside of the back, is the following; "Jacobus Stainer, in Abiam prope Cenopontum, 1647." Cenopons is the Latin name of Inspruck in Germany, the chief city of Tyrol. These violins, since solos have been

laid aside, have lost somewhat of their former favour, and the Amati and Straduarii violins of Cremona, which are of a more full and rich tone, are preferred for leading a band, playing modern symphonies, and solo concertos à grande orchestra.

STAINES, or **STANES**, in *Geography*, a market-town in the hundred of Spelthorne, and county of Middlesex, England, is seated on the northern banks of the river Thames, over which there is a strong timber bridge at this place, connecting the counties of Surrey and Middlesex. It is sixteen miles from Hyde-Park corner, and most of its houses extend along the sides of the great western road; but the parish church, with a few buildings, are situated nearly half a mile N.W. of the chief mass of building. The parish consists of 748 acres 16 perches of cultivated land, with 666 acres 1 rood and 20 perches of arable land. On a stratum of loam is a soil of fine black mould, and gravel is found in some places. According to the population report of 1811, this parish contained 355 houses, and 2042 inhabitants.

In old records Staines was written *Stana*, a Saxon word for a stone; and Camden supposes that the name was derived from a stone, which was fixed in, or on the bank of the river here, to denote the extent of the jurisdiction of the city of London over the Thames, westward. A stone, bearing the date of 1280, on the margin of the water near the church, is still preserved here. An annual fair of four days was granted in the year 1228 to the abbot and convent of Westminster, and is still continued: a weekly market is held on Fridays. The civil government of the town is vested in two constables and four headboroughs. Staines bridge appears to have been one of the most ancient in the country; so far back as the year 1262, three oaks out of Windsor forest were granted for its repairs by Henry III.; and numerous grants of pontage, or temporary tolls for the same purpose, were made from time to time, in many of the subsequent reigns, as appears by the records in the Tower. These tolls were confirmed and enforced by acts of parliament in 1509 and 1597. In 1791 an act was passed for building a new bridge, and allowing certain tolls to defray the expence of the building. Under this act a stone bridge, of three arches, was begun in August 1792, and opened in March 1797: but in consequence of one of the piers giving way, the bridge was necessarily taken down. One of cast-iron was next substituted, but this also failed, and the builders were obliged to support it by wooden piles and frame-work. The bridge in its present state was completed in 1807. The parish church consists of a chancel, nave, and north aisle, separated by circular columns and pointed arches. The door of the chancel is of early Norman architecture. A square embattled tower at the west end was built by Inigo Jones in 1631, as appears by an inscription on the south side. In an apartment under the gallery staircase are two unburied coffins, covered with crimson velvet, and richly embellished, containing the bodies of Jessie Aspasia, wife of F. W. Campbell, esq. and of her brother, H. Caulfield, esq.; the former died in 1812, the latter 1808. The Quakers, Anabaptists, and Methodists, have each a meeting-house in this town. A school on the Lancastrian principle of education has been recently established, and is supported by voluntary contribution; a convenient building has been erected for this purpose Lyfons's Middlesex Parishes, 4to. 1800. Beauties of England and Wales, vol. x. Middlesex. By J. N. Brewer.

STAINHOF, a town of Austria; 3 miles S.W. of Vienna.

STAINING of Bone, Horn, Hair, and Ivory. See each article, and also **DYEING of Bone, &c.**

STAINING of Marble. See MARBLE, and *Solutions, &c.* of STONES.

STAINING of Paper and Parchment. See PAPER and PARCHMENT.

STAINING of Porcelain. See PORCELAIN.

STAINING of Stones. See *Solution, and Colours* of STONES.

STAINING of Wood. See WOOD and DYEING

STAINKIRCHEN, in *Geography*, a town of Austria; 4 miles N. of Schwanaftadt.

STAINS, a town of France, in the department of Paris; 6 miles N. of Paris.—Also, a lake of Prussia, in Nantangen; 48 miles S.E. of Konigsberg.

STAINTZ, a town of the duchy of Stiria; 10 miles S.E. of Voitsberg.

STAINVILLE, a town of France, in the department of the Meuse; 7 miles S.E. of Bar-le-Duc.

STAJO, or **STAJA**, in *Commerce*, a corn measure of Italy, equal at Florence to 4 quarti, 16 metadeli, or 32 mezzate. The moggio, which contains 8 facchi, or 24 itaja, is equal to about 16 English bushels. Salt is measured by the stajo, which weighs 72 lbs. Florence weight, or 54 lbs. avoirdupois. The stajo of Corfica is equal to 6104 cubic inches, and 28.60 stajo = 10 English quarters. The staji of Leghorn = 1501 cubic inches, and 114.60 staji = 10 English quarters. The staji of Lucca = 1472 cubic inches, and 116.85 staji = 10 English quarters. The staji of Milan = 1055 cubic inches, and 162.96 staji = 10 English quarters. That of Modena = 4297, and 40 staji = 10 English quarters. The staji of Turin = 2388 cubic inches, and 73.56 staji = 10 English quarters. The staji of Venice = 4943 cubic inches, and 34.78 staji = English quarters.

STAJOLUS, among the *Romans*, a measure of length, used in surveying land; it was equal to five palms and three-fourths of a palm.

STAIRCASE, an ascent inclosed between walls, or a balustrade, consisting of itairs or steps, with landing-places and rails; serving to make a communication between the several stories of a house.

The dimensions of stairs are differently assigned by different authors; in this however they agree, that they must not be more than six, nor less than four inches high; nor more than eighteen, nor less than twelve inches broad; nor more than sixteen, nor less than six feet long each stair. But these measures have only regard to fine buildings, ordinary houses are excepted; yet even in these, the stairs are not to exceed eight inches in height, nor be less than nine inches in breadth, nor three feet in length.

To reduce the dimensions of stairs to some natural, or at least geometrical standard, Vitruvius borrows the proportions of the sides of a right-angled triangle, which the ancient school expressed by the numbers 3, 4, and 5. The first for the perpendicular height; the second for the horizontal breadth; and the third for the whole slope or inclination, from the edge of one stair to that of another.

But this rule is set aside, and with good reason, by the modern builders. For, on this principle, the lower the stairs, the narrower they must be; and stairs, for instance, four inches high (such as we find mentioned by ancient architects), must be but five and one-third inches broad.

One rule to be regarded in the making of stairs is, that they be laid according to the Italian phrase, *con un tantino da scarpa*, i. e. somewhat sloping, or a little highest behind, that the foot may, as it were, both ascend and descend at once; which, though observed by few, is found a secret and delicate deception of the pains in mounting.

The construction of a complete staircase is one of the most

curious works in architecture. The common rules to be observed in it are as follow.

1. That it have a full free light to prevent accidents of slipping, falling, &c.

2. That the space over head be large and airy, which the Italians call *un bel sfacato*, good ventilation, because a man spends much breath in mounting.

3. That the half paces, or landing-places, be conveniently distributed for reposing in the way.

4. That to prevent rencounters, &c. the staircase be not too narrow; but this last is to be regulated by the quality of the building.

5. That care be taken in placing the staircase, so that the stairs may be distributed, without prejudice to the rest of the building.

The kinds of staircases are various: in some, the stairs are *straight*, in others *winding*, in others both ways, or *mixed*.

Again, of *straight* stairs, called also *fliers*, some fly directly forwards; others are square; others triangular; and others are called *French fliers*.

Of *winding* stairs, called also *spiral*, or *cockle-stairs*, some are square, some circular, and some elliptical. And these, again, are various; some winding round a solid, and others round an open newel.

Lastly, of *mixed* stairs, some are called *dog-legged*; others both wind about a solid newel, and fly about a square open newel.

STAIRS, *Straight*, are such as always fly, that is, proceed in a right line, and never wind; whence their denomination.

Of these there are several kinds; as,

Direct fliers, or *plain fliers*, which proceed directly from one floor to another, without turning either to the right or left; these are seldom used, except for garret or cellar stairs.

Square fliers, which fly round the sides of a square newel, either solid or open, having at every corner of the newel a square half step, taking up one-fourth of a circle; so that they fly from one half step to another, and the length of the stairs is perpendicular to the side of the newel.

Triangular fliers, which fly round by the sides of a triangular newel, either solid or open, having at each corner of the newel a trapezial half step, taking up two-thirds of a circle; so that they fly from one half step to another; and their length is perpendicular to the side of the newel.

French fliers, which fly first directly forwards, till they come within the length of a stair of the wall; and then have a square half pace, from which you immediately ascend to another half pace, from which the stairs fly directly back again, parallel to their first flight.

STAIRS, *Winding*, are such as always wind, and never fly; of these there is great variety; as,

Circular winding stairs, of which there are four kinds, viz. such as wind about a solid newel, the fore-edge of each being in a right line, pointing to the centre of the newel; commonly used in church-steeple, and great old houses: such as wind round an open newel, the fore-side of each being in a right line, pointing to the centre of the newel; as those in the Monument, London: such as wind round a solid newel, only the fore-side of each an arc of a circle, either concave or convex, pointing near to the circumference of the newel: and such as resemble the last in all other respects, save that they have an open newel. Any of these winding stairs take up less room than other kinds.

In stairs that wind round a solid newel, architects make the diameter of the newel either $\frac{2}{3}$, or $\frac{1}{2}$, or $\frac{1}{3}$, or $\frac{1}{4}$ of that of the

the staircase, according as that is in bigness. If very small, the newel is but $\frac{2}{3}$, and if large $\frac{7}{8}$, &c.

In stairs that wind round an open newel, Palladio orders the newel to be one half of the diameter of the staircase; though there does not appear any reason why the newel here should not be proportioned to the staircase, as in the former.

As to the number of stairs in each revolution; Palladio orders, that, in a staircase six or seven feet diameter, the stairs in each revolution be twelve; if the diameter be eight, the stairs to be sixteen; if nine or ten, the stairs to be twenty; and if eighteen, to be twenty-four.

Elliptical winding stairs, of which there are two kinds; the one winding round a solid, the other round an open newel: they are much of the same nature as circular stairs, excepting that, in the one, the newel is a circle, and, in the other, an ellipsis.

Square winding stairs are such as wind round a square newel, either solid or open; the fore-side of each square being in a right line, pointing to the centre of the newel.

Triangular winding stairs are such as wind round a triangular newel; the fore-side of each being a right line, pointing to the centre of the newel.

Columniated winding stairs.—Palladio mentions a staircase, in Pompey's portico at Rome, set on columns, so as that the light they receive from above, may distribute itself to all parts alike.

Double winding stairs.—Scamozzi mentions a staircase in this form, made by Pedro del Bergo, and Jean Coffin, at Sciamborg, in France, in the king's palace. It is so contrived, as that two persons, the one ascending, and the other descending, shall never meet.

Dr. Grew describes a model of this kind of staircase, kept in the Museum of the Royal Society. The foot of one of the staircases, he says, is opposite to that of the other; and both make a parallel ascent, and within the same cylinder. The newel in the middle is hollow, and built with long apertures, to convey light from candles placed at the bottom, and on the sides of the newel into both cases.

Quadruple winding stairs.—Palladio mentions a staircase of this form, in the castle of Chambor, near Bloys. It consists of four staircases, carried up together, having each its several entrance, and going up one over another, in such manner, as that, being in the middle of the building, the four serve to lead to four apartments; so that the people of the one need not go up and down the stairs of the other; yet being open in the middle, they all see each other pass.

Mixed stairs are such as partly fly, and partly wind; whence some call them *fliers* and *winders*. Of these there are several kinds; as,

Dog-legged stairs, which first fly directly forwards, then wind a semicircle, and then fly directly backwards, parallel to that.

Square fliers and winders have a square newel, either solid or open; and fly by the sides of the newel, winding a quadrant of a circle at each corner.

Solid and open newelled fliers and winders are of two kinds; the one winds a quadrant of a circle about a solid newel; then flies by the side of a square open newel; then winds again by the side of a solid newel; then flies again, and so alternately. The other flies first, then winds, and then flies again alternately.

STAIRING, in *Geography*, a town of Austria; four miles W. of Voglabruck.

STAIRS, in *Building*, the steps by which we ascend

and descend from one story of a house to another. See **STAIRCASE**.

STAITH is a stage or strong wooden scaffold, to which coal-waggons are conducted by a rail-way, in order to shoot their contents into hips, boats, or carts.

STAKE, in *Agriculture*, a long piece of branch-wood, or strong staff or stick fixed upright in the ground, in making hedges, between which the brush-wood is laid and interwoven in the making of them.

STAKE, the name of a small anvil used by smiths; sometimes it stands on a broad iron foot, on the work-bench, to be moved up and down occasionally; and sometimes it hath a strong iron spike at the bottom, by which it is fixed to some place on the work-bench. Its use is to set small and cold work straight, by hammering it on the stake, or to cut and punch upon it with the cold chissel, or cold punch.

STAKE of a Plough. The stake is an upright piece of wood, passing at its bottom through that link of the tow-chain which passes through the box of the plough, and at its upper end receiving the end of what is called the *bridle-chain*, which ties it to the crow-staff, or if it be not long enough, a wyth, or cord, is used to tie it: it is also tied to it again, a little below the pillow of the plough, by another wyth or cord. See **PLOUGH**, **PILLOW**, **CROW-STAVES**, &c.

STAKES, in *Ancient Armoury*, were long and pointed at both ends, and used to protect the archers from the attacks of the enemy's horse: these were planted in the earth, sloping before them. In the first of Edward VI. three hundred and fifty of these were in the stores of the town of Berwick, under the article of archers' stakes: there were also at the same time eight bundles of archers' stakes in Pontefract castle.

STAKE-Heads, in *Rope-making*, are posts, about four feet long and four by three inches square, with four wooden pins fixed in the upper side to keep the strands asunder. For lines they are about two feet long and three by two inches square, and have six pins.

STAKE-Posts, are posts of oak, about four feet high and twelve inches diameter, with a mortise-hole in each, for the stake-heads to go in and out, to keep the rope from the ground. They are placed about ten yards distant from each other, along the whole length of the rope-walk.

STAKING, *Pointing*, or *Sharpening Hop-poles*, the art and practice of rendering their bottom parts pointed and sharp, in somewhat the manner of the common hedge-stake, in order that they may be set into the ground or soil in a firm and ready manner. See **HOP**, and **STACKING and Pre-serving Hop-poles**.

STAL-Boat, a kind of fishing-boat mentioned 27 Eliz. c. 21.

STALACTAGNIA, in *Natural History*, the name of a genus of spars. The word is derived from the Greek *σταλακτιος*, *stillatitious*, or formed by dropping, and *αγνος*, *pure*.

The bodies of this genus are formed by the dropping of water from the roofs of subterranean caverns, and are the purer sort of what are called by authors *stalactites*. They are crystalline sparry bodies, formed into oblong conical figures, composed of various crusts, and usually found in form of icicles. Of this genus there are three known species. Hill.

STALACTITE, plural *Stalactites*, in *Minerology*, are the pendent protuberances from the roofs or sides of caverns, formed by the deposition of calcareous or other earths, from the water which percolates through rocks.

Some

Some waters, that rise from beds of limestone, are so overcharged with calcareous earth, as to form an incrustation of stone round any substance that is immersed in them for a short time; of which we have well-known instances in the waters of Matlock, in Derbyshire, and Knaresborough, in Yorkshire: such are called petrifying springs. It is by a similar process that stalactites are formed, by the water dropping from some projecting point and depositing a part of its contents; succeeding drops continue to enlarge the deposition, which frequently assumes the form of an icicle, and is sometimes of considerable size.

Stalactites form so rapidly in some caverns and mines as to close up the entrance, and even fill up the excavation entirely. The depositions of calcareous earth formed on the floors of caverns, by the water which drops from the roof, are called *stalagmites*.

Though the formation of stalactites apparently depends on the mechanical deposition of earthy matter, and may seem to admit of an easy explanation, there are some peculiarities of structure in stalactitical masses which it is more difficult to account for.

In some stalactites we may observe a radiated diverging crystalline structure; in others, the lamellar structure of calcareous spar is observable when broken, and they divide into rhombs, or the regular primitive crystals of carbonate of lime. The progress from the radiated to the regular crystalline structure may be seen in the same specimen: thus it should appear, that the particles of the stalactite, after they had been mechanically deposited, and formed a solid, were capable of a certain degree of motion, which permitted their crystalline arrangement to proceed to its ultimate form, or the primitive rhomb. Some stalactites have occasionally been found which were tubular; other stalactites, that are solid, are covered with minute crystals, and sometimes are terminated by a knob, resembling a mushroom. Stalactites are not unfrequently formed under the arches of bridges, by the percolation of water through the mortar.

In the Geysers, or boiling springs of Iceland and other parts of the world, siliceous stalactites and stalagmites are formed on the sides of the rocks on which the water falls, or in the basins which surround the springs. These natural basins are indeed entirely formed of siliceous depositions, and it has been ascertained, that the waters contain a considerable portion of silica in solution.

The larger and more compact masses of stalactites are employed in statuary. This substance was much used by the ancients, and called *alabastron* and *alabastrites*. The alabaster of the moderns is more frequently gypsum, or sulphate of lime.

The alabaster from stalactite is sometimes of a pure white, but this kind is not so durable as that which is of a light yellow colour, or veined. The iron, which is the colouring matter, communicates to the stone a great degree of hardness, and on this account the coloured alabaster was more prized by the ancient sculptors than the pure white. See *STONE for Statuary*.

STALACTITIC, formed like stalactite.

STALACTOCIBDELA, in *Natural History*, the name of a genus of spars. The word is derived from the Greek *σταλακτιος*, *stillatitious*, or formed by the dropping of water, and *κιβδηλος*, *impure*.

The bodies of this genus are formed by the dropping of water from the roofs of subterranean caverns, and are the coarser kinds of what authors have called stalactite. They are crystalline-terrene spars, formed into oblong bodies, and

found hanging from the roofs of caverns and grottoes. Of this genus there are only two known species. Hill.

STALAGMITÆ. See *STALACTITE* and *STALAGMOSCIERIA*.

STALAGMITE, in *Mineralogy*, the deposition of earthy matter, formed by drops of water on the floors of caverns. The word is derived from the Greek *σταλαγμα*, a drop. See *STALACTITE*.

STALAGMITIS, in *Botany*, so called by Murray, in the Göttingen Transactions, v. 9, from *σταλαγμα*, a dropping, or *distillation*, because of the gum yielded by this tree.—Schreb. Gen. 729. Willd. Sp. Pl. v. 4. 980.—Class and order, *Polygamia Monoecia*, or rather *Polyadelphia Polyandria*. Nat. Ord. *Guttifera*, Jull.

Gen. Ch. *Cal.* Perianth inferior, deciduous, of four roundish, concave, coloured leaves, fleshy in the middle, bordered; the two outermost coriaceous, smallest; the two innermost thinner and veiny. *Cor.* Petals four, obovate, rather coriaceous, fringed, spreading, larger than the calyx; the two opposite ones largest. *Stam.* Filaments about thirty, inserted into a fleshy quadrangular receptacle, club-shaped, abrupt, somewhat quadrangular, erect, the length of the corolla, united into five sets; anthers erect, of two round lobes. *Pist.* Germen superior, globose; style erect, thick, short; stigma of four inversely heart-shaped, spreading, permanent lobes. *Peric.* Berry globose, of one cell, crowned with the style and stigma. *Seeds* three, oblong, obscurely triangular, "terminated by a joint."

Some male flowers are interspersed, in which there is no germen, only the thread-shaped rudiment of a style in some of them, with a prickly unequal imperfect stigma. Koenig observed the calyx to consist occasionally of six leaves, while the stigma was only three-cleft. Schreber doubted whether the stamens were always polyadelphous.

1. *S. cambogioides*. "Murray Comm. Goett. v. 9. 173." Willd. n. 1.—Native of Camboja and Ceylon. A middle-sized tree, with opposite spreading branches. *Leaves* opposite, ovate, acute, entire, flat, coriaceous, rigid, dark-green, smooth on both sides; occasionally obovate. *Footstalks* very short. *Flowers* axillary or lateral, whorled; the male ones either intermixed with the others, or in a cluster by themselves. *Murray*. This tree appears nearly akin to the *ΧΑΝΘΙΟΧΥΜΟΣ* of Roxburgh, see that article hereafter; Ait. Hort. Kew. v. 4. 420; yet we must presume them to be different on account of the great authorities on which the latter depends.

STALAGMODIAUGIA, in *Natural History*, the name of a genus of spars. The word is derived from the Greek *σταλαγμα*, a drop, and *διαυγης*, *pellucid*. The bodies of this genus are the purer kinds of what authors call stalagmitæ, or drop-stones.

They are spars found in form of small balls, each composed of numerous crusts, and considerably pellucid and crystalline. Of this genus there are three known species. Hill.

STALAGMOS, a term used by authors to express a distillation of rheum from the head.

STALAGMOSCIERIA, the name of a genus of spars. The word is derived from the Greek *σταλαγμα*, a drop, and *σκιερης*, *opaque*, and expresses an opaque spar, which has received its form from the dropping of water.

The bodies of this genus are the coarser kinds of what are called by authors stalagmitæ, and are small round masses, composed of numerous thin crusts, and of an opaque and coarse structure.

Of this genus we have only two known species. Hill. Scotland affords a vast variety of the stalagmitæ. One

cave, about eight miles distant from Aberdeen, on the sea-side, has its whole roof crusted over with stalactites, of a foot in length, hanging down like the fringe of a bed; the floor also is as deeply covered with congeries of stalagmites; the upper coat, both of these and the stalactites, is of a sea-colour, but the inner parts are as white as sal prunellæ; the water which drops from these is of a very peculiar nature, for it is to acrimonious, that if it touch the skin but ever so slightly, it makes it smart. Near this cave there is another hollow rock, in which the stalactites make a very beautiful figure: they are all formed into long and thick columns, and stand perpendicularly, so that they represent the pipes of an organ; when broken, they are all found to be hollow within. The rock, and all the stone thereabouts, is of the limestone kind.

STALBRIDGE, in *Geography*, a small market-town in the hundred of Brownshall, in the Sherbourne division of Dorsetshire, England, is situated near the banks of the river Stour, on the N. side of the county; 9 miles E. from Sherbourne, and 113 miles W.S.W. from London. The manor was anciently the property of the abbey of Sherbourne: after the dissolution of monasteries, Edward VI. granted it to the duke of Somerset; on his death it passed to the Audley family, and afterwards to Richard, earl of Corke; he bequeathed it to his son Robert Boyle, who resided here many years; and his first chemical experiments were made in the manor-house in 1647. Peter Walter, esq. clerk of the peace for Middlesex, afterwards purchased the manor, and in his family it has since continued. The town of Stalbridge, and the greater part of the parish, are seated on a rocky stratum, whence the vicinity is supplied with stone for building and other uses: the principal manufactory here is that of stockings, which is carried on to a very considerable extent. Two fairs are held annually, and a market weekly, on Thursdays. In the population report of 1811, the number of houses in this parish is stated to be 141, of inhabitants 890.

In the centre of the town is a stone cross, which, including the base, is thirty feet high. At the top is a square block, with four niches; those on the east and west fronts have the Crucifixion, with the Virgin, and St. John. On this block stood a cross; and from the top of the free-stone of the pyramid to the hole in which this cross was fixed, the height is ten feet. At the bottom of this block are several coats of arms; one of them seems a chevron or fess between three roses or escallops. The pyramid itself is twelve feet high, and all the angles are fluted. On one side of it is a defaced figure of our Saviour, with the lamb at his feet. The four sides of the base are adorned with reliefs, one of which seems to represent the resurrection of Christ, who holds a cross in his hand. The whole stands on three octagonal flights of steps, each diminishing in the ascent. Hutchins's History of Dorsetshire, 3 vols. fol. 1796, &c.

STALE, in *Agriculture*, a term used provincially to signify the handle of any thing or kind of tool, as a fork-stale, &c.

STALE, in *Rural Economy*, a term applied to the urine of animals: the stale of horses and some other animals should be carefully preserved for use in the way of manure. See URINE.

STALE also denotes a living fowl, put in a place to allure and bring others where they may be taken. See DECOY.

For want of these, a bird, shot, his entrails taken out, and dried in an oven, in his feathers, with a stick thrust through to keep it in a convenient posture, may serve as well as a live one.

STALE Furrow, in *Agriculture*, a term applied to a furrow

which has been long turned up, or in which the slice has been for some time exposed to the weather, in contradistinction to that which is newly formed, or in a fresh state. See SOWING.

STALE Seeding, the custom or practice of seeding or sowing land which has been long turned up, or in the ploughed state. The practice, though common, and held in much esteem with some in different places, should probably never be had recourse to, except in some cases with wheat, as where a firm and solid bottom is required in consequence of the too great friability or loose powdery quality of the soil, as in putting that crop in after potatoes, in some instances, and other similar products, which are apt to cause a very light state of the mould or soil. On account of the convenience of breaking up the lay grounds during a part of the winter season in some situations, stale seeding of the land has been practised, especially with oats and some other sorts of seed; but how far it has been found either beneficial or detrimental, has not yet perhaps been fairly put to the test of experiment. See SOWING.

STALE Sowing, in *Gardening*, the practice of sowing or putting in some sorts of seed into ground which has been dug up some time, and is in a stale condition. This is in some instances the case with peas, beans, and some other leguminous seeds, as well as those of some other kinds; but it ought always to be as much as possible avoided. See SOWING of Seeds.

STALECKE, in *Geography*, a town of France, in the department of Mont Tonnerre; 1 mile N.N.W. of Baccach.

STALIKON, a town of Switzerland, in the canton of Zurich; 6 miles S.W. of Zurich.

STALIMENE. See LEMNOS.

STALING, a term used to signify the act of evacuating the urinary bladder in the horse or mare, or other animal of the same kind. In team as well as other horses, it is a humane and necessary practice to suffer them to void their urine at full leisure, and to encourage them to it by *whistling*, or any other of the soothing methods which they may understand. The evacuation of urine is liable to interruption, profusion, and to be diseased from various causes, and thereby to produce much injury to the animals.

But neither team nor other horses are much subject to stale blood, unless in cases where they have sustained some hurt, or been strained in the loins or kidneys, and when some of the blood-vessels about the neck of the bladder have been ruptured or burst open, or in cases of erosion taking place there, or in the passage of the urine, by means of which some of the smaller and more minute vessels of these parts may have been laid open, and send forth a bloody sort of discharge; but when this last happens, it is mostly very small in quantity, and but of short duration, commonly going off without any assistance in the way of medicine.

In cases where the urine passes off in an intermixed bloody state, or blood comes away in an almost pure or clear condition immediately after the staling of the animal, the complaint may be removed, if the horse is strong, well fed, and in a full condition, by bleeding in a pretty plentiful manner, according to the size and state of the animal; but if he be of the team hard wrought kind, and low in condition, it must be used in a much more sparing way, and, in many instances, be wholly omitted. After bleeding, and in those states of the disease in which it is unnecessary, the use of mild astringent opiate remedies may often be employed internally with great advantage; such as the red restringent gum, in the quantity of two, three, or more drachms, according

ording to circumstances, in *fine powder*; oak-bark, or that of the Peruvian kind, in powder, two or three ounces; and powdered crude opium, from a scruple to about half a drachm; mixed and made up into a ball with a little honey or treacle, and given to the horse once or oftener in the day, until the bloody staling discharge goes off and wholly disappears, which is ascertained by the animal staling in a free and perfect manner. Other similar sorts of astringent substances and barks may likewise be made use of with perhaps equal benefit, where these cannot be had, as well as some restringent tinctures, such as those of the above gummy matter and several others. All these remedies should constantly be given in large quantities of some kinds of mucilaginous liquids, as the free use of such substances is found to be highly beneficial in all cases of this nature.

After such complaints are wholly removed, the strength of the animals may be restored by the giving of such powdery substances as are directed below, in full quantities of oatmeal or other sorts of gruel, as there may be occasion. The powder of the root of gentian, and that of Peruvian bark, in the proportion of from one to two or more ounces; ginger in powder, one ounce or more; and sometimes the rust, or the salt of steel powdered, in the quantity of about half an ounce of the former, and from one and a half to two drachms of the latter. The horses should likewise have a pretty free use of mashes of different nourishing sorts.

There is a profuse sort of staling in horses of the farm, team, and other kinds, which sometimes constitutes and becomes a disease. See DIABETES.

STALK, among *Botanists*, that part of a plant which rises immediately from the root, and which usually supports the leaves, the flowers, and the fruit.

The term *stalk* is used on all occasions; but in speaking of the grasses, and gramineous plants, the word *culm* is used in its place, to distinguish that peculiar kind of stalk which is general to all these plants, and is not found in any others.

The terms used in describing the stalks of plants are, a *simple stalk*, one which runs up undivided from the root to the top.

Naked stalk, one that has no leaves.

Foliose stalk, one with leaves on it.

Ramose stalk, that which sends out branches.

Erect stalk, that which rises straight up.

Oblique stalk, that which is slanting.

Voluble stalk, that which twills round other things.

Flexuous stalk, that which bends.

Reclinate stalk, that which swoops towards the ground.

Procumbent stalk, that which lies on the ground.

Creeping, or sarmentous stalk, that which emits roots as it runs along.

If the stalk be rounded in shape, it is called *round*; if it make two angles, *ancipital*; if three, *trigonal*; if four, *square*; if more, *polygonal*.

If the stalk be lightly ridged and furrowed on the surface, it is said to be *friated*; if more deeply, *canaliculate*; if full of protuberances, *scabrous*; if lightly hairy, *villose*; if more roughly, *hispid*.

In the *branched stalk*, if the branches rise erect, it is expressed by *ascendant*; if they spread, by *diffuse*; if they are very large, it is called *branchiated*.

If the stalk divaricate, or, instead of sending out branches, it divide into them, it is called a *composite stalk*. If these divarications proceed by pairs, or if every branch be divided only into two others, it is called *dichotomous*; if it part into two series of branches, it is expressed by the term *dislichous*;

if it part into a multitude of ramifications, it is called *subdivided*.

All these terms are used also in expressing the different states of the *culm*, which, having no articulations, is called *equal*; when scaly, *squamose*.

STALK, in *Agriculture*, the stem or stock part of any sort of grain, grass, or other kind of plant that is grown as a field crop.

The stalks of many sorts of field plants are much disposed to be affected with different kinds of vegetable diseases, as those of the mildew, the rust, and several other sorts, which produce speckled, spotted, freckled, or other appearances on them.

The stalks or stems of many different field plants of the cabbage, borecole, rape, and other kinds, are not unfrequently left standing as very useful and necessary spring feed for ewes and lambs, as well as other sorts of sheep-stock, by the sprouts or small leaves which they throw out at that season in such an abundant manner.

The cutting over the stems or stalks of some sorts of plants is occasionally practised in the view of increasing the size or quantity of their produce, as in the case of the potatoe, and some other similarly rooted kinds; but from the trials which have lately been made on the subject, it would seem that harm rather than good is mostly the consequence of the practice.

The stalks of grasses and some other plants of that sort may, in some instances, and in particular cases, be cut over, cropped, or fed down by animals, especially of the sheep kind, with great benefit in rendering them more fine and more spreading, by which the herbage as well as the sward of the land is much improved.

There may likewise be other ways in which the management of the stalks in different sorts of plants may probably be beneficial in their cultivation, as by thinning, topping, and stripping off their leaves, &c.

STALK, in *Gardening*, the stem, upright, or rising part of any sort of culinary vegetable or other plant which is raised or cultivated in gardens or pleasure-grounds. The stalks of garden vegetables are, for the most part, of either the crisp, tender, fleshy eatable kinds, or of the more hard and ligneous sorts. The former are, in most cases, rendered more suitable and proper as food by being blanched, or having their colouring matters discharged from them in some way or other, as in celery, endive, sea-kale, and some others. The latter, being commonly only for temporary or future use and produce, rarely require any thing to be done to them, except the cutting and clearing away of the irregular or decayed parts towards the close of the summer, or other season; as they are of the annual, biennial, or perennial kind.

The stalks of some sorts of garden plants occasionally require to be stopped in their growth, in order to render them more productive in fruit, seed, or other matters, by having their extreme parts twilted or cut off, as is sometimes practised with the cucumber and other similar plants, as well as in the bean and other crops of that description. And the hard solid stalks of some kinds of garden plants, after they have been cut over, and their heads removed for use, are still suffered to stand in their places, or to be taken up and replanted in other situations, in the view of throwing out or sending forth fresh crops of edible shoots of the green kind. See SPROUTS, *Esculent*.

The stalks of all garden vegetables should, in general, be kept in as free and open a state of growth as possible, as when too close or too much crowded they never succeed so well, in whatever intention the plants from which they proceed

ceed may be raised or cultivated. They likewise, in some cases, require to rise quickly, in order to be good or of a proper quality.

The stalks of several different sorts, too, stand in need of support, as all those of the twining and some other kinds.

STALKER, in *Brick-making*. See **BRICK**.

STALKERS, in our *Old Writers*, a kind of fishing-nets. Stat. 13 Rich. II. cap. 20.

STALKING, a term of considerable import in fowling; applied to a kind of screen, or device to hide the fowler, and amuse the game, while he gets within shot.

Of such devices there are several kinds.

STALKING-HORSE, is a horse trained up for the purpose. This horse should be chosen of the tallest and largest kind; no matter how old he is, but he must be well trained, and ready at command. The horse, being properly trained, will walk slowly along in any sort of ground, as stubble-fields, moorish places, or the banks of rivers, and will always feed, or pretend to feed, as he is directed. The sportsman is to conceal himself and his gun behind the horse's fore-shoulder, bending his body low by his side, and keeping the whole body of the horse always full between the fowl and himself: when by this means the sportsman is come so near to the birds, that the gun will reach them with strength to kill, he is not to attempt advancing any nearer, that they may not be disturbed. Some recommend the shooting over the horse's buttocks, and some over his neck, but the best way is under the neck, and before the breast, for by this means the body of the sportsman is covered by the shoulder, and his legs by the legs of the horse. When the birds are shot, the dog will bring them to his master, and as they often fall in places where a man cannot come at them, this creature is of very necessary service.

This is the best of all methods of stalking; but as such a horse is difficult to train, chargeable to keep, and is not always to be had, there are many contrivances introduced to supply the place of it: among these, the principal are the stalking-wheelbarrow, the stalking-bush, and the stalking-hedge. The first of these is to be thus contrived; take a wheelbarrow, made on purpose of light fir, and set round about it boughs and bushes in such a manner, that you may fit in it, and not be discovered by the fowl, and drive it along without giving them disturbance.

The stalking-bush is to be contrived of several bushes well platted together, with all their leaves on; it is to be fastened to a stake, which is to have an iron point at the end; the whole is to be the height of a man, and thickly set with boughs all the way, from top to bottom. When the sportsman sees his game before him, he is to advance slowly with this artificial bush between him and them; when he is come within a proper distance, he is to fix the bush into the ground, by running in the iron spike, and then to shoot through the boughs.

The stalking-hedge is generally made about nine feet long, and a yard and a half high: it is to be made of small wands, so woven together, as to give room for the placing of green boughs among them, that it may resemble a great growing hedge: this is to be carried before the sportsman, and, in the manner of the bush, it is to be fastened down when near enough for the gun to kill from it.

As birds, however, are apt to have some apprehension of terror from seeing a tree or hedge move, these machines are to be carried on very slowly; and the resemblance of a real animal, as a horse, or cow, are better for the purpose: these may be made of canvas, supported on a slight frame, and with tails of hair. For pheasants, woodcocks, and the

like foolish birds, the common flat figure of a horse will do; but the water-fowl are generally much more shy, and it is necessary, for the getting near them, to have the body made hollow, and stuffed with hay, or some other matter, to keep it out. The proper time to use these engines is either early in the morning, or late in the evening; for the sun-shine in the middle of the day very soon discovers to the fowl the imperfection of the engine.

STALL, in *Rural Economy*, a sort of inclosed place, in which a horse, cow, or any other kind of animal of the same or other description, is fed, foddered, or kept; as a division or separate portion in a stable, cattle-shed, cow-house, or any other building of the same nature. See **CATTLE-Shed**, **COW-HOUSE**, and **STABLE**.

In the stalls, the cattle, in the most improved modes, are commonly tied up, and fastened to upright round posts of about four inches in diameter, made perfectly smooth on their surfaces, by means of loose iron rings and small wooden bows or bands, which are put round the necks of the cattle, and slide readily up and down in the rings on the posts, as the cattle may want them. The upper parts of the bows, yokes, or bands, are molly flat, and have two holes in them; and the bow or band parts, which are in general formed of tough split ash, have a sort of button or knob at each end of them, which is put into the circular holes of the flat head-pieces, when, by the spring of the bows or bands, the knobs or buttons are prevented from returning, by their slipping over into nicks or notches made in one end of the head-pieces, where they become fixed until the animal be wanted to be let out, which is readily done by a little pressure being made on the bow parts. These stalls have, in many cases, cribs also contrived for the cattle to eat their fodder out of or in. And passages are not unfrequently formed in front, or before the heads of the cattle, for the convenience and facility of giving them their fodder from, as much saving in time and labour is thereby produced.

The stalls in the cow-sheds, houses, or *linneys*, as they are called in some of the south-western districts of the kingdom, have their boxes or cribs so formed, as to contain the hay, straw, and other similar matters for the cows in winter, and the lucern, tares, vetches, and other such materials, in the summer season. They have also troughs for turnips, potatoes, cabbages, and other food of the same kind. And likewise vealing places for the calves, which are rendered a little dark, in order to promote the process of fattening them. There are sometimes, too, large separate stalls or divisions for such cows as are near calving, or have just calved. For young cattle-stock they are occasionally divided, also for three-years old, two-years old, and one-year old ones, in order that the young beasts may not get injured or inconvenienced by running among the others. And the head-ways, by being made shorter in proportion to the size of the different year's growth of the animals, render them capable of all dunging into the same grip or gutter, and consequently of being more readily cleaned and kept in order.

The divisions or stalls for the fattening of bullocks or oxen should always have sufficient space, without allowing any unnecessary waste of it, as where two oxen are fattened in one stall from eight to ten feet, that is, four or five feet to each beast, according to the size of the beast usually fattened. These divisions, in the beds or foundations of them, should constantly decline in a gentle manner backwards, so as to draw off the urine, and have a small rising at the heels of the animals, as in the cow-sheds or houses, and for the same purposes.

There should be a crib or manger in each stall, which should have the conveniency of a separate partition for different

ferent articles of food, as meal, oil-cake, bran, chaff, and others of the same kind, without their mixing or being blended with turnips, cabbages, potatoes, hay, or other such matters of fodder; and besides, a pump for supplying water to the animals, conducting or leading it to the different troughs which are formed for receiving it in each of the stalls.

In some cases, keelers are put in every stall for affording water to the cattle, which have troughs of communication, in order to convey it from pumps in the farm-yards to large general troughs on the outside of the ox-houses, which is afterwards separately conducted to each keeler, so that all the time and trouble in untying, tying, and driving to the water, are ingeniously and usefully avoided. The keelers or troughs, in these circumstances, are placed even with the cribs or mangers, and are mostly of the same sizes and dimensions.

In connection with all large ranges of ox-stalls, there should always be a weighing machine, in order that the owners may at any time instantly ascertain what are the state and progress of the beasts, as well as that the improvement they make, and the expence of food, or the flesh, and the food necessary to produce it, may be fairly compared. By this means, the sorts of cattle which give the greatest quantity of flesh meat with the smallest quantity of food, in these feeding stalls, may likewise be usefully and readily decided, which is a point of the utmost importance to the stock-feeding farmer.

STALL-Fed, a term applied to animals fed in the stall with dry food, and not with grass or other similar matters.

This sort of feeding is highly beneficial to the farmer, in raising and producing large quantities of the best kind of dung manure; but is rather expensive in the materials, and the different conveniencies which are necessary for the practice of it. See the following article.

STALL-Feeding, the art or process of fattening neat cattle in the stall. The best practice in this sort of fattening is, probably, that of wholly confining them to the stalls, which is usually termed stall-feeding; as by this means they are kept quiet, and free from interruption, and of course feed more quickly, and with greater regularity, which seem to be points of great importance in this system of management with these animals; though there are some who are still in favour of the yard management.

In regard to the sorts of food that may be employed in the way of winter fattening the animals in this practice, the principal of the more succulent kinds are carrots, parsnips, potatoes, Swedish turnips, cabbages, common turnips, grains, and some others; and of the more dry sorts, oil-cake, and other matters of that kind, oats, barley-meal, rye-flour, bean and pea-meal, and others of the same nature, with different sorts of straw and haulm cut into chaff by means of machinery, or hay cut in the same manner. It is usual with some to employ the different meals in a state of mixture in nearly equal proportions, except the bean-meal, which, from its heating quality, is mostly made use of in smaller quantities. But on the principle of fresh sorts of food having a more powerful effect on the systems of animals, when first applied, it may be more beneficial to have them given in alternation, or at distant intervals, as their effects may in this way be more fully experienced. And in respect to the cut straw and hay that are made use of in this way, the first should, contrary to the practice usually adopted, be prepared from that which is fresh threshed out, and not such as has been long packed together, and is become stinky. The hay, instead of being of the inferior kind, should be the best the farm affords, and such as is not in the

least injured in the smell or taste by keeping. It has, however, been stated by Mr. Dark of Herefordshire, an experienced grazing farmer, that the more inferior sort of hay has, by the addition of a very small proportion of common salt, been made to be preferred to the best, when prepared in that way. The quantity of it used with flooded meadow hay was only about eight pounds to the ton; and his oxen of the breed of that district did better with it than others which had the best hay. The whole of the advantage is ascribed to the portion of saline matter mixed with it, acting as a stimulus or condiment on the stomachs of the animals.

Upon the principles of this sort of feeding, the author of the System of Practical Agriculture has offered several physiological observations, that deserve attention, but which our limits will not allow us to insert.

In this management, it is a matter of the utmost importance for the animals to be kept constantly free from standing in any dirt or nastiness, by having the dung daily removed and cleaned out, and their standings swept out as clean as possible; being then littered down with dry clean litter, so as to prevent any sort of nastiness from adhering to their skins, or affording them uneasiness during their fattening. And in order to effect the littering in the most perfect manner, as much straw, or other similar matters, should be made use of as can be converted into manure, as from one to two or three tons each beast; as the dung will fully repay the expence of it, in the improvement which it must afford to the land on which it is applied. In this process it is also of much advantage to have the cattle sheltered, and kept in a due degree of warmth, without being too hot; as when the heat is too great, there may be disadvantage by too much perspiration being produced. In regard to the giving of the food in this process, the state of the appetites of the cattle, or other animals, should be nicely watched, and the quantities adapted, so as that it may be eaten up perfectly clean. With the more sweet succulent sorts, too much should not, however, be given at a time; but be duly combined with some of the dry kind. And where cut dry meat is chiefly employed, it is the best practice, probably, to keep some of it always in the cribs or boxes, so that the cattle may take it at pleasure, or as they find themselves disposed.

It has been stated, that where succulent food is made use of with cut dry meat, which is in general a more profitable method to the farmer than that of having recourse to corn and oil-cake, or the different sorts of meals stated above, carrots, parsnips, potatoes, and the Swedish turnip, would seem to stand the highest as articles for this use; the common turnip and cabbages having been found much inferior in their fattening properties. The two first are equal to almost any other sort of food in this view, being capable of fattening the largest cattle. And the most general practice is to employ these roots and plants without any other preparation, except that of being sometimes cut, sliced, or chopped, in a box for the purpose; giving only a small proportion at a time, at three or four different periods in the course of the day, in cribs properly contrived for the purpose; due supplies of such cut straw, in mixture with hay, being, where necessary, provided and given in the intervals of such feeds. It is found that in this method much less water will be necessary, than when dry meat is wholly made use of in the process, as the animals are much less thirsty from the succulence of the food.

Farther, the nutritious properties of the carrot have been found very considerable, when employed in this way; and this root has some great advantages, as the animals readily take

take to it, and a great proportion of food is capable of being raised on the acre. It was found by Mr. Young, in his trials with this root, that the consumption with an ox of about sixty stone weight was *per day* about ten stone, giving in addition cut hay and chaff, or some other similar dry material. The parsnip is also a root of equal, if not superior, merit in this management. An acre of either of these roots would complete the fattening of two such beasts as the above, if taken from the pastures in a half-fattened condition. It has indeed been suggested, that these two roots and the potatoe approach the nearest of any to that of the oil-cake in their fattening properties, but are certainly inferior to that substance in this intention.

The white and red beets, and the scarcity root, or mangel wurzel, have also been found highly beneficial in this application.

And there have been many trials made with potatoes in the stall-fattening of animals, in which it has been fully shewn that, both in the raw and boiled or steamed states, they are a root that occasionally answer very well. It has been found, that small cattle of the Welsh and Scotch runt kind have been ascertained to consume about a bushel each in the course of the day, with from fourteen to sixteen pounds of hay, or some other cut dry food. In the raw state, some dry food of these sorts is indispensibly necessary, in order to correct the purgative quality of the root; and when boiled or steamed, it has likewise a good effect in affording due distention to the stomach. When given to milch-cows in a raw state, the milk is found to be greatly increased, but to be of a poor thin quality. There can be no doubt, but that where the steaming or baking of the root can be accomplished at a cheap rate, and in a convenient manner, the food will be much better suited to the purposes of stall-feeding, as being much more nutrient and agreeable to the animals.

On this subject it is stated by an excellent grazier, J. H. Campell, esq. of Charlton, in Kent, in answer to queries proposed to him by Mr. Young, that 100 bushels of potatoes and 700 weight of hay are generally sufficient to fatten an ox that thrives tolerably well. And in giving the roots, they should at first be used in small quantities, which should then be gradually increased to one or two bushels *per day*, dry food being always intermixed, and the proportion of hay being uniformly regulated by the effect which the potatoes produce on the bowels. There ought to be at least four or five servings in the course of a day, as according to the quantity of roots which a beast can be induced to eat with appetite, he will fatten the sooner, and of course with less expence to the farmer, and consequently more profit be obtained. The hay should be cut once, or, if it be not very weighty, twice along and three times across the truss, so as to be in square pieces of eight or ten inches in proportion; in which state the cattle will eat it and digest it more readily, while their fattening is considerably expedited. But the potatoes need not, he thinks, be cut, except at first, in order to entice the beast to eat them; but they ought always to be fresh and clean. Corn or meal is not absolutely necessary; but when at a moderate price, it may be employed with advantage. But in case a scowering should be brought on by the use of raw potatoes, which often happens, the quantity of hay, meal, or other dry food given with them, should be increased considerably, till the beasts become accustomed to the roots, when this inconvenience will be removed.

Stall-feeding of bullocks with potatoes, given in different states of preparation, has been for some time extensively practised in Sussex, and is much approved of by many. They

there find that a beast of from one hundred and forty to one hundred and sixty stone weight eats from one to two bushels of the roots in the course of the day, but consumes little hay, as not much more than ten or twelve pounds, in that space of time. This root has probably not yet been tried, by giving it when artificially sprouted; but it would perhaps answer well in this way. Some have, however, lately begun to question the merit of potatoes in this mode of cattle-feeding, as not being so valuable, when compared with some other sorts of food. And a careful experimenter, who was largely in the practice of fattening oxen with them, it is said, gave them up, from the conviction that, with every advantage of breed, attention, warmth, and cleanliness, in regard to the animals, they would not pay more than four-pence the bushel.

Further, the Swedish turnip, when it is cultivated in a proper manner, is a most valuable root, when used in this intention, being very sweet and palatable to the animals, and at the same time possessing more nourishing power than the common turnip; of course, going much farther. In some trials which we have lately attended to, it was found to have the advantage nearly in the proportion of one-fourth; and in other experiments, it is said to have gone still farther in this use.

Also cabbages, in combination with dry chaffy materials of different kinds, have been long known to answer well in keeping store animals in the winter; and, when made use of with good hay, to be capable of fattening large cattle in an expeditious manner. It has been found by correct trials, that the daily consumption of this vegetable is mostly in the proportion nearly of one-fifth the weight of the animal: of course, an ox weighing about sixty stone consumes about twelve stone *per day*. In some experiments made long ago by Mr. Turner, detailed in the second volume of Mr. Young's *Six Months' Tour*, an ox of eighty stone was found to consume fifteen stone of this plant, with the addition of half a stone of hay. And that with regard to its properties of feeding oxen put to it, when in low condition, in November, they became in a state of fatness, and ready for the market, in the March following, having the weight of eighty stone; mostly increasing in value in the course of four months, about five pounds ten shillings. It is evident that, in this proportion, an acre of this crop of thirty tons would be sufficient for stall-fattening three beasts of the same size and weight.

And common turnips, according to Mr. Marshall, are, in Norfolk, given in different ways to cattle in fattening them; as by being drawn and thrown thinly and evenly upon the grass, stubble, and other lands, in order that the cattle may consume them in such situations; in which cases, they have not any allowance of hay during the whole process of fattening.

But another mode of giving this root to fattening cattle is, it is said, by means of close bins, or small cribs, with boards or bars nearly close at the bottom, while the beasts are kept in a loose straw-yard. These bins are dispersed over the yard, and the turnips are put into them whole; the tap-root, and also the tops, unless they are fresh and palatable, being previously cut off, so that the fattening animals receive only the bulbs; the tops, if eatable, being consumed by store cattle. And that while the bullocks are in the yard, they have the straw sometimes given them in cribs, and at others it is scattered in small heaps about the yard, twice or thrice a day: the quantity thus eaten is very trifling; and with the last mentioned management, the yard becomes evenly littered without farther trouble. But this mode of fattening is attended with somewhat more

STALL-FEEDING.

labour than that of throwing turnips abroad, which, it is thought, is the preferable management, if the soil be sufficiently dry to support the stock, and light enough to stand in need of being rendered firm by treading: on the contrary, where the land is deep, and the season is wet or severe, the straw-yard is the more comfortable place, provided it be kept dry and well littered, and be furnished with open sheds, in which the flock can shelter themselves. For though the *teat* of fattening cattle abroad is greatly beneficial to light soils; yet, if bullocks, while fed in the yard with turnips, are well littered, they will make a large quantity of excellent manure, that will amply compensate for the additional labour occasioned in that way.

A still farther method consists in keeping the cattle tied up in stalls, hovels, or beneath open sheds, with mangers or troughs for receiving the turnips, which, in this case, are frequently sliced, or more generally, though perhaps less eligibly, cut into quarters, by means of a small chopper, upon a narrow board or stool, beneath which is a basket for catching the pieces.

It has, however, been supposed that turnips, though very frequently employed in the process of stall-feeding, are greatly inferior to cabbages, as, besides their being more liable to injury, they probably possess the fattening property in a less degree than any of the substances that have been noticed above. And the proportion in which they are consumed by the fattening stock has been found to be something more than a third of the weight of the cattle, by some; but by others, about a third in the day, as stated in the Gentleman Farmer. However, in other experiments, carefully made, an ox of from seventy to eighty stone has been ascertained to eat something less than three hundred weight in the course of the day, besides chaff and hay; and small cows of about thirty stone, one hundred weight and three quarters in the same space of time. And in the Rev. Mr. Close's trials, it was found, that when consumed in stalls or sheds, an acre of good turnips will completely winter-fat an ox of fifty score, besides affording manure for an acre and a half of land; but if fed upon the land, two acres will not fatten one so well, and the dressing will be partial, and of but little value. When this root is given in the stall, from its very succulent nature, it becomes necessary to employ as much dry food as possible during the use of it, in order to the expeditious fattening of cattle by such means.

It has also been practically remarked by a late writer, that the turnip is often employed in the fattening of sheep, somewhat in this way; and that in this application it is frequently advantageous, where the management is conducted with judgment. But to derive the greatest profit from this practice, it is probably the best method to only make use of them for such sheep as are in a considerable state of forwardness; as such as are poor, when turned to this sort of food, are seldom found to pay well for it. Every farmer who has applied turnip crops in this way, must, it is said, have found this to be the case. Where the soils are sufficiently dry, the best method of consuming them may be on the lands, by means of hurdling; but under the contrary circumstances, they may be drawn and eaten upon a dry piece of sward.

Turnips, as well as potatoes, have been steamed for this purpose. See *STEAMING of Cattle-Food*.

As to the use of brewers' grains, they can only be had recourse to in this way in particular situations, as near large towns, or other places where they can be had at a reasonable rate, and in sufficient quantity: and of this sort of

food, that which is the produce of large distilleries is found the most beneficial in this sort of feeding. The quantity made use of for moderate sized beasts is usually from a bushel to a bushel and a half, three times in the course of the day; hay or cut dry food being given between the periods of feeding with these matters. But this sort of substance seems to be much less powerful in its fattening properties, than any of those articles that have been mentioned above. Still, with good hay, it is probable that these matters may be made to fatten animals in a tolerably expeditious manner.

But besides these different substances, there are others of a less succulent quality employed in this practice: the first, perhaps, in respect to the properties of feeding, is that of *oil-cake*, that is, the refuse material left after expressing the oil from linseed. See *OIL-Cake*.

It is asserted that these cakes have a very extraordinary effect on cows before calving, causing their milk to flow more copiously, and preparing the animal in a good manner for the period of calving. But as the fat of beasts, fattened on oil-cake, is not supposed by some so good for food, and to be of a less firm texture, it has been advised to substitute linseed jelly, which is infinitely superior, and which, when mixed with a due proportion of hay or meal, affords an excellent composition for stall-feeding and fattening. This jelly is prepared in the following manner: to seven parts of water one part of linseed is only put, for 48 hours; then boil it slowly for two hours, gently stirring the whole, lest it should burn; afterwards it should be cooled, and mixed with meal, bran, or cut chaff. In the experiment of Mr. Moody, an eminent grazier, two quarts of this jelly were used *per* day to every large bullock, which proportion amounts to little more than one quart of feed in four days, and produced a great saving in the article of food in this process. And in America, experiments have been made with *linseed-oil*, mixed with the meal of Indian corn. The stall-fed steer, to which this composition was given, was observed to thrive rapidly, and to sweat most profusely; but, through inattention, too large a proportion of oil was given at one time with the food, which disgusted the beast, and occasioned the experiment to be discontinued. There can, however, be no doubt but that linseed or flax-feed jelly is more agreeable to cattle than cake, while it renders them less liable to surfeit, in case an extra quantity should be accidentally given; and is less liable to affect the meat with a peculiar taste than either oil or cake, and consequently it merits a further trial. To each bullock, or fattening animal, about half a gallon of jelly may be given every day, mixed with meal and cut straw; but it will be requisite to change this food about a month before the beast is killed, to prevent, if possible, the flesh from retaining the flavour of the oil-cake or jelly, as they, each of them, may be liable to affect it in some measure.

Further, where sheep are fattened with oil-cake, they require it to be brought into a much finer state than for cattle in general, and which may then be mixed with bran, or other similar substances, and put in the troughs or cribs for the animals to feed at.

Also, on the same principle as that of oil-cake, the use of linseed-oil and bran has been attempted, but probably with less success in the application. The consumption in this mode, for beasts of the smaller size, is something more than half a peck of bran three times in the day, with a third of a pint of linseed-oil well stirred into it: with this, good hay or cut chaff is usually given. But it is a mode attended with more trouble than that of cake-feeding, without any
great

great superiority in the effect that is produced; and it can only be employed where the oil is cheap, and to be had with convenience.

Linseed and barley mixed and ground together, in the proportion of two pecks of the former to two bushels and a half of the latter, have been found very beneficial in stall-feeding, in Suffex, when given to summer-soiled or pastured animals in the yards, in the beginning of the winter season. Of this mixture each ox has two bushels in the week given him, besides wheat-chaff and hay. They fatten rapidly, it is said, in this way.

And another article, equal, if not superior, to any of these last kinds, in this sort of fattening, is that of oats, which may be given either in the straw or when threshed; for neat cattle it is probably best given in the former state, but for sheep in the latter, in shallow troughs or cribs made for the purpose, so as to prevent its being blown out of them. The consumption, in this sort of food by sheep, is usually from two or three to four or more pounds each *per* day, according to the size and kind which are fattened; but with neat cattle it must be proportioned to the animals in different respects.

Where barley or other meals are employed, they are best made use of in their dry states for sheep, in mixture with the cut or other matters that are given at the same time in their cribs or bins; but for neat cattle they are sometimes mixed up and blended with liquid materials in different forms. These substances have much effect in promoting the fattening of the animals; but they can seldom be made use of with much profit, except for the best sort of cattle or sheep. Where sheep are fattening on the turnips, these sorts of food are also excellent in correcting the watery properties of that root. Several other substances of the dry kind have likewise been employed in the stall-feeding of different sorts of animals, such as the dust and combs of malt, cut pea and bean-haulm, and other similar matters, which have been found highly beneficial.

Also, in this practice, the use of food in a sour state has been advised by some; as in this condition, it is said, experience has shewn it to be useful in the keeping and fattening of swine. But experiments are still wanting on this subject. And on the same principle, it has been recommended as a food for large cattle, which has been done by fermenting rye, flour, and water, into a kind of paste, and then diluting it with water; and also, when thickened with hay, cut small, it is said to fatten quickly. This practice chiefly prevails in France, whence it was introduced into this country. But concerning the efficacy of acid food in stall-fattening animals, there is much difference of opinion.

It may be stated, that it is now found that the wash or refuse of malt, remaining after distillation, which was formerly applied exclusively to the feeding of swine, may be used in this way with profit; and that it has, of late years, been applied with much success. The cattle fed in this manner are asserted, not only to repay the expence of their keeping, by fattening speedily, but also to yield a large quantity of valuable manure. This substance has been extensively and successfully applied in stall-feeding by Messrs. Hodgson and Co., the proprietors of Bolingbroke-House distillery, Battersea, near London, where the proprietors have erected stalls for fattening about 350 head of cattle at one time, with wash and grains, and a certain portion of hay *per diem*, with the view of enabling them to chew the cud. They are said, between October and April, which is their regular working season in the distillery, to fatten about 600 bullocks; having generally about 300

in the house tied up at one time, and about 100 in an adjoining orchard to take in, to replace such as are sold off, or in consequence of any expectation of an approaching advance in meat. They have no stated period for fattening these bullocks, being regulated entirely by the state of the markets; but from ten to sixteen weeks are about the usual time, and the cattle are found to gain, upon an average, from three to four stone *per* week.

Another substance has been employed in this way with equal success, which is that of molasses or treacle; though the expence incurred by the use of this article will probably prevent its general application. It was first used in the West Indies by Mr. Millington, who found it, in combination with farinaceous substances, and, when these could not be procured, with cane-tops, oil-cake, and other articles of dry food, together with a little hay, or not too green fodder, greatly to expedite the fattening of cattle in general, and of old and decayed oxen in particular. He gave from half a pint to a pint of molasses twice in the day to very starving animals, which had been exhausted by continual and severe labour for a series of years. In adopting this article, a gallon of oats, or other damaged grain, roughly ground, or the same quantity of potatoes, should be boiled in a sufficient proportion of water to form a thick wash. It must be well stirred while on the fire, to prevent it from burning or sticking to the sides of the vessel; and when it becomes cool, the mixture is to be formed into balls of about one pound weight each. These balls are divided into two equal portions, which, being previously immersed in the treacle, are given to the beasts morning and evening. They will devour them with eagerness, and will speedily thrive and fatten by the addition of a little hay, or any green fodder, that is not too succulent. Farther, one or two spoonfuls of salt may be dissolved in the composition, which will contribute to preserve the health of the animals; and in case corn cannot be conveniently procured and ground, pulverized oil-cake, diluted in water, and seasoned with a small quantity of salt, with the same proportion of molasses, may be advantageously substituted. And there are probably many other refuse saccharine or sweet substances, formed in different manufactures, that might be employed in the fattening of cattle in this way.

Where this sort of business is conducted on an extensive scale, it is of the greatest utility to have a machine for the occasional weighing of the cattle, as they advance in their fattening; as, without such assistance, there are but few persons who are capable of judging whether they go on in a profitable manner or not. But by weighing them from time to time, at the distance of every eight or ten days, in the morning before they are fed, this may be correctly ascertained; and where they fall off, or do not advance in a sufficient degree to the preceding weighing, such changes may be made in their food, water, and management, as are the most likely to promote their fattening in the most perfect manner, and with the greatest profit.

STALLAGE, **STALLAGIUM**, in our *Old Writers*, the liberty, or right of pitching and erecting stalls in fairs and markets, or the money paid for the same.

STALLATI, in *Geography*, a town of Naples, in Calabria Ultra; 1 mile E.S.E. of Squillace.

STALLED, in *Rural Economy*, a term signifying tired with eating in animals, or a kind of loathing of food in them. It also signifies set fast in a slough or bad road with carts or waggons.

STALLING, in *Agriculture*, a term applied to the practice of foddering, feeding, and fattening neat cattle

in stalls, or the tying or binding them up in them for any other purpose.

STALLION, in the *Manege*, in French *etalon*, a stone-horse kept to breed. See *HORSE*, and *Breeding of HORSES*.

In the reign of Henry VII. a large number of mares, as well as geldings, were turned after harvest into the common pastures, and no stoned horses were allowed to mix with them; and it is at this day contrary to law to turn a stoned horse into a common pasture. Those horses which were kept to cover mares were always confined in safe and inclosed grounds, but more frequently in the stable, and were called "equi ad stabulum," by contraction, *stallum*. Hence were derived the Italian term "stalloni," the French "etalon," the English "stallion," or "stalled" horse; which expression prevails, and is in use at present with regard to the ox, which sometimes being kept from the pasture in order to be fattened, is called "the stall-fed" and "stalled" ox. In the reign of the succeeding prince, particular regard was paid to the raising of a breed of good and strong horses, and laws were made for the more certain attainment of this end. The only method of securing strength and size in the progeny, is to select the fires and dams of a certain proportion, size, and mould, and to permit no mare or stallion to breed, but under these restrictions. In order further to secure a breed of large horses, a singular kind of law was passed, which obliged every archbishop and duke, under penalties, to keep seven trotting stoned horses for the saddle, each of which was to be fourteen hands high at the age of three years. Afterwards minute directions were issued, with regard to the number of horses of the same kind, which were to be kept by other ranks and degrees, each in proportion to their circumstances and station.

The reasons for enjoining stone-horses to be kept must have been for the sake of breeding, and for the superior labour they were thought to be able to undergo; and as they were more expensive to maintain than mares or geldings, it being necessary to separate and keep them apart, the rich and noble only were required to keep them in numbers proportioned to their rank and ability; while the lower people used geldings, for the advantage of turning them to grass. Brood-mares, two at least, were ordered to be kept by those who had parks, inclosures, and other conveniences. Berenger's *Horsefanship*, vol. i.

STALLUPONEN, or **STALLUPEIONEN**, in *Geography*, a town of Prussian Lithuania, the principal trade of which consists in cattle; 33 miles S.E. of Tilsit. N. lat. 54° 33'. E. long. 22° 58'.

STALOWITZ, a town of Lithuania; 10 miles from Pinsk.

STALTWASSER, a river of Wurtemberg, which runs into the Lein, 2 miles S. of Welzen.

STAMBACH, a town of Germany, in the principality of Culmbach; 12 miles E. of Culmbach.

STAMEN, in *Botany* and *Vegetable Physiology*, the ancient Latin name for the part in question, now become English in the place of its old appellation, *chive*. The stamens are organs of impregnation, essential to every flower, either in the same individual with the pistils, or in a corresponding one of the same species. (See *PISTILLUM*, and *FECUNDATION of Plants*.) They are seated externally with respect to the pistil, internally with respect to the calyx and corolla. They are inserted either into the calyx, the corolla, or the receptacle, rarely either upon the germen, or the style. Their number differs in different genera or species of flowers, from one to an hundred or more.

Each *Stamen* commonly consists of two parts, the *FILA*-
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MENT and **ANTHER**; see those articles. The latter only is essential, being of a capfular texture, containing the *POLLEN*, whose nature and office will be found explained in its proper place. The *Anther*, when arrived at maturity, either bursts by the contraction of its membranous coat, or opens by appropriate cells for the discharge of the pollen, of which last circumstance the genus *Erica* affords beautiful examples. In *Laurus* and *Leontice*, even in some species of *Solanum*, each cell of the anther has a proper lid. These cells are usually two; but in *Tetratheca* and *Vatica* they are four. Sometimes the anther is ornamented with a crest, or with a pair of bristles, of both which various *Erica* exhibit specimens. In *Pinus* the crests of the anthers prove useful for specific discrimination.

The *Stamens*, according to their number, situation, and proportion, furnish the leading principles of distinction in the artificial, or sexual, system of Linnæus; see *CLASSIFICATION*.—These organs are liable to be changed into petals, in what are termed double flowers; and if that change be complete, they can no longer serve the purpose of impregnation.

STAMFORD, in *Geography*. See *STANFORD*.

STAMFORD, a township of Upper Canada, in the county of Lincoln, lying on the W. side of Niagara river, and S. of Newark. A port of entry and clearance is established in this township, on the N. bank of Chippawa river, near the bridge.—Also, a township of Vermont, in Bennington county; containing 378 inhabitants.—Also, a post-town of Connecticut, in Fairfield county, on a small stream called Mill-river, which discharges itself into Long Island sound; containing a congregational and episcopal church, and 4440 inhabitants; 10 miles S.W. of Norwalk, and 44 N.E. of New York. This township was formerly called "Rippowanns," and was settled in 1641.—Also, a post-town of New York, in Delaware county, taken from Woodstock, and incorporated in 1792, containing 284 families, and 1658 inhabitants; 60 miles S.W. from Albany.—Also, a post-town in Lincoln county, Kentucky; 628 miles from Washington.

STAMFORD Islands, a cluster of small islands near the coast of North Carolina. N. lat. 34° 37'. W. long. 77° 10'.

STAMINA. See *STAMEN*.

STAMINA, in the *Animal Body*, are those simple, original parts, which existed first in the embryo, or even in the seed; and by whose distinction, augmentation, and accretion by additional juices, the human body, at its utmost bulk, is supposed to be formed.

All that is essential to the animal, are the stamina, which exist *in ovo*; the rest being foreign, additional, and even accidental.

The stamina seem to coincide with the solids, which are surprisingly small in quantity.

STAMITZ, JOHN, in *Biography*, the illustrious father of a renowned musical family, concert-master and director of the chamber music, or court concerts of the elector palatine at Manheim, in 1756, was born at Teutechebrodt, in Bohemia, where his father was cantor in the principal church. It was during his time, and by his example, that German symphonics, in a style different from the overtures of Lulli, Handel, and the Italian opera composers, began to be cultivated and in favour all over Europe. It was under him that the late earl of Kelly placed himself as a scholar on the violin, and a student in composition; and it was also under him that the Manheim band, by its experiments and new effects, became, during thirty years, the most celebrated in the musical world.

The genius of Stamitz was truly original, bold, and

nervous: invention, fire, and contrast, in his quick movements; a tender, graceful, and insinuating melody, in the slow; together with the ingenuity and richness of the accompaniments; characterize his productions, all replete with great effects, produced by an enthusiasm of genius, refined, but not repressed, by cultivation.

The following is a list of his principal works, which we advise true lovers and judges of good music to purchase wherever they can find them: as, though more than forty years old, in spite of fashion and a rage for novelty, they will long continue to be good music; "VI Sonate da Camera à 2 Violini e Basso," Noremb. 1761. "VI Sonate à Violino Solo e Basso, Op. 6," Paris. "VI Sonate choisies pour le Clavecin avec Violon, Op. 1ma." Paris. In MS. he left unpublished, six symphonies, twenty-one violin concertos, two harpsichord concertos, and nine violin solos.

STAMITZ, CHARLES, the worthy son of so great a father, was born at Manheim in 1746, and studied under Canabich. In 1767 he was admitted into the elector palatine's chapel, as principal second violin. He has travelled since all over Europe, and given specimens of his spirited compositions and performance, particularly on the tenor. He was in England about the year 1780, and performed at Bach and Abel's concerts. He composed a duet for a violin and tenor, which Cramer and himself performed to the wonder and delight of all hearers. This duet has often been played since by great performers on the tenor, violin, and violoncello. On this instrument, we believe Linley was the last.

In 1770 Charles Stamitz went to Paris, where he gained great applause by his compositions and performance on the tenor and viol d'amour. In 1785 he returned to his own country, and exercised his skill and talents at Berlin, Dresden, and Helle Cassel; in all which places he continued writing for almost all kinds of instruments.

STAMITZ, ANTHONY, the younger brother of Charles, was born in 1753, and became eminent likewise by his compositions and performance.

STAMMERING, in *Physiology*, an hesitation or interruption of speech, which seems generally to arise from fear, eagerness, or some violent passion, that prevents a child's articulating rightly, by the confusion which it occasions in the vibrations that descend into the muscular system, so that, finding himself wrong, he attempts again and again, till he hits upon the true sound. It does not therefore begin, in general, till children are of an age to distinguish right from wrong in respect of pronunciation, and to articulate with tolerable propriety. A nervous disorder of the muscles of speech may have a like effect. When the trick of stammering has once begun to take place in a few words, it will extend itself to more and more from very slight resemblances, and particularly to all the first words of sentences, because then the organs pass in an instant from inactivity to action, whereas the subsequent parts of words and sentences may follow the foregoing from association; just as in repeating *memoriter*, one is most apt to hesitate at the first word in each sentence. A defect of memory from passion, natural weakness, &c. so that the proper word does not occur readily, also occasions stammering, and, like all other modes of speaking, it is caught, in some cases, by imitation.

Sometimes stammering takes place only in the utterance of such words as begin with certain letters, which are generally some of the labial or guttural consonants, as *b, p, m, c, g*, &c. Some persons, on the contrary, stammer in the utterance of all words indiscriminately, with whatever letter they begin, whether they be vowel or consonant, at certain

times only; as *e. g.* when the speaker is placed in any situation that occasions hurry or embarrassment. Agreeably to the observations already made, we find that persons of great nervous irritability, and lively consciousness, are most liable to stammering. This sort of impediment is a bad habit, founded upon this constitutional susceptibility: and in attempting to remove stammering, while every attention should be paid to such means as physical and medical science will point out for the strengthening of the corporeal system, it is of the utmost importance to induce the persons affected with it to reason on the subject. Let them practise the formation of the component parts of words, (that is, simple vocal sounds and the powers of the consonants,) singly, and in combination, alternately, till a facility and habit of subjecting the muscles concerned in speech to the will be acquired or regained. They should be accustomed to consider that which is true in fact, that the organs of speech are moved by muscles which, from the laws of animal economy, are the instruments of the will; though we are conscious of an act of the will only at the commencement of such actions.

To counteract stammering, therefore, we must appeal to the understanding, and endeavour to arouse the will into vigilant and vigorous controul of the muscles. When a hesitation happens, let a volition or direct act of this power take place: first to cease muscular motion altogether, and then to commence a new series. The greatest deliberation and recollection should be used in ordinary conversation; and the act of speaking, as such should be constantly present to the mind, till the wrong habit be overcome, and the right so confirmed as to leave no room to apprehend a relapse. The voice should be carefully pitched at that tone which nature in the individual points out as easiest to the organs, and most agreeable to the ear; and by no means should a hurried pronunciation, or fictitious voice, be resorted to. It should be studiously remembered, that we are accountable to no one for the innocent and decorous exercise of our muscular powers—that over them we ourselves alone ought to have controul—that speech, on proper occasions, is not only an innocent and a decorous, but, in the eyes of others, a necessary and an agreeable exercise of our muscles. Why then be thrown into perturbation and confusion, when we are to perform an action, confessedly in our power; and which others have not only no right to prevent, but are desirous that we should perform? If this train of reasoning be fairly entered upon, many other arguments will suggest themselves, and must inevitably produce good.

The following directions, with variations according to circumstances, will be found to be attended with advantage, if duly and perseveringly complied with.

In order to raise a voice, or that material of which speech is formed, let the vowels be practised in a natural key, but with firmness and strength, for ten minutes or a quarter of an hour, at least, every morning. Then let the powers of the consonants be formed, in their order, singly, and variously combined with the vowels.

After a little rest, if imagination supply a subject, by all means let an imaginary conversation take place for twenty minutes, half an hour, or even an hour, in a firm and natural tone of voice, using every effort of fancy, to suppose it directed to persons indiscriminately; that is, sometimes to servants, sometimes to equals in age and rank, and sometimes to elders, or those considered as superior in consequence and rank in society, from whatever cause. But if imagination do not furnish a topic, then let the time be spent in reading, in a tone as nearly approaching to the ease of familiar conversation as possible, taking care to manage the
fancy

fancy as above. This will furnish the lesson:—and after an interval of a few hours, the same sort of conversation or reading should be repeated, two or three times more in the course of a day. And on mixing with real auditors, every exertion should be made to associate the ideas of their imaginary, with their actual presence.

These directions, it will be perceived, are founded upon the principle of the association of ideas; than which a more powerful principle, in the formation of human habits, cannot be conceived.

An ingenious writer, whose observations we are now citing, is of opinion, that it may be laid down as an incontrovertible position, that persons possessing an ordinary mental capacity, with an adequate share of industry and strength, may *certainly* overcome the habit of stammering, by means such as here pointed out. See “*Instruction of the Deaf and Dumb,*” &c. by Joseph Watson, LL.D. 2 vols. 8vo. 1809.

STAMNOS, an urn, or vessel for holding water. Some authors have made it signify the bucket-head, as it is called, of those alembics which have no worm, but are cooled about the head by this means.

STAMP, a term used in some places for a weir, or waterfall.

STAMP-Duties, are a tax imposed upon all parchment and paper, on which any legal proceedings, or private instruments of almost any nature whatsoever are written; and also upon licences for retailing wines of all denominations; upon all almanacs, newspapers, advertisements, cards, dice, and pamphlets containing less than six sheets of paper. These imposts are very various, according to the nature of the thing stamped.

This tax, though in many instances very burdensome, is of service to the public in general, by authenticating instruments, rendering it much more difficult than formerly to forge deeds of any standing; since, as the officers of this branch of the revenue vary their stamps frequently, by marks perceptible to none but themselves, a man that would forge a deed of king William’s time must know, and be able to counterfeit the stamp of that date also.

The first institution of the stamp-duties was by statute 5 & 6 Will. and Mar. c. 21; and they have since, in many instances, been increased by subsequent statutes very far above their original amount. It would far exceed the limits of this work to recite all the duties of this kind that already exist; but it may not be improper to mention some of those that are most common.

By 44 Geo. III. c. 98. the several stamp-duties granted by any act of parliament then in force were repealed, and upon every almanac or calendar, for any time not exceeding one year, was imposed the duty of 1s.; for each and every year for which almanacs or calendars for several years shall be made, published, or intended, 1s.; and for a perpetual almanac or calendar, 10s. The calendar or perpetual almanac in any bible or common prayer book is specially exempted. Books or pamphlets serving the purpose of an almanac or calendar are subject to the same duty respectively, and to the same exemptions. (See ALMANAC.) For the stamp-duty on newspapers and pamphlets, see NEWSPAPERS.

By 44 Geo. III. c. 98. the several duties before imposed upon cards and dice made in Great Britain were repealed, and a new duty was imposed upon such cards and dice, *viz.* upon every pack of cards which shall be made fit for sale or use in Great Britain, 2s. 6d.; and upon every pair of dice fit for sale or use in Great Britain, 1l. See CARDS.

In one of the acts, *viz.* 10 Ann. c. 19. relating to the

stamp-duties, which are become in process of time very numerous and intricate, there is a clause which brings all the rest within the jurisdiction of the justices of the peace, and it is as follows: Two justices residing near the place where any pecuniary forfeitures not exceeding 20l., or any act touching any of the duties under the management of the commissioners of the duties on stamped vellum, parchment, and paper, shall be incurred, or any offence against any of the same acts shall be committed in any wise relating to the same duties, by which any sum of money only may be forfeited, may hear and determine the same; who shall, on information or complaint, within a year after the seizure made or offence committed, summon the party accused, and witnesses; and may issue warrants for levying the penalties by distress and sale, if not redeemed in six days. The said justices may at pleasure mitigate the penalties, the charges being first allowed; so that they do not reduce the penalty to less than double duty, over and above the said charges. The justice, before whom the offending person is convicted, shall levy the penalty, and apply the same as the act directs; and in default of sufficient direction, the same shall be applied, half to the king, and half to the person who shall prosecute for the same, if within six months after the offence is committed; but if after six months, the whole shall go to the king (26 Geo. III. c. 82.); which conviction shall be filed by the clerk of the peace, and shall not be removable by certiorari into any other court; but nevertheless subject to appeal to the quarter-sessions, in such manner as by any former act is directed. But now by the stat. 44 Geo. III. c. 98. s. 10. no action or information shall be commenced or filed in any court, or before any justice or justices of the peace, for any penalty or forfeiture under any of the stamp acts, but in the name of the attorney-general, or in the name of the solicitor or some other officer of the stamp-duties. And all penalties and forfeitures under the stamp-acts are to be applied to the use of the king, &c.; but the commissioners of the stamps may give such part of the penalty to the informer as they may think expedient.

By the 44 Geo. III. c. 98. all the duties and drawbacks under the care of the commissioners of the stamps shall cease from October 10, 1804, except as to the recovering of any penalties incurred previously thereto; and after that time certain duties are made payable, as specified in the schedules to that act annexed. By the 48 Geo. III. c. 149. the several duties in the schedule (A) to the former act annexed are repealed, excepting in certain cases.

By 55 Geo. III. c. 184. the duties granted by 48 Geo. III. c. 149. are repealed, together with the duties on pawn-brokers’ licences (44 Geo. III. c. 98.), and those on policies of insurance in the West Indies, or elsewhere beyond the seas, granted in the 50th year of his majesty’s reign, and the per-centage duty on insurances against fire, granted by 44 Geo. III. c. 98. all arrears excepted. The duties specified in the schedule annexed to 55 Geo. III. c. 184. are to be levied, and are committed to the management of the commissioners of stamps, who are to provide proper stamps, &c. By the same act, any person actually forging stamps, &c. and his aider or abettor, being lawfully convicted, shall suffer death as a felon, without benefit of clergy. It is further enacted, that all powers and provisions of former acts, together with fines, forfeitures, &c. shall extend to this act. The provisions of former acts respecting agreements shall be applied only to those that are charged with 1l.; and it is enacted, that the agreements charged with a duty of 1l. 15s. shall be subject to the same regulations as deeds hereby charged with a like duty. This act provides, that instruments having wrong stamps, but of

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sufficient value, shall be valid; except in cases where the stamps used on such instruments shall have been specially appropriated to any other instrument, by having its name on the face thereof. It is further enacted, that the penalty for making, accepting, or paying bills of exchange, &c. without being duly stamped, shall be the forfeiture of 50*l.*; and the penalty of post-dating bills of exchange, &c. shall be the forfeiture of 100*l.* The penalty for issuing unstamped drafts on bankers, without specifying the place where issued, or if post-dated, is 100*l.* The penalty for receiving such drafts is 20*l.*, and on bankers for paying them, 100*l.* It is enacted, that promissory notes to bearer on demand, not exceeding 100*l.*, may be re-issued by the original makers, without further duty; nor shall such notes be liable to further duty, though re-issued by certain persons, not strictly the original makers. Notes re-issuable under 48 or 53 Geo. III. are to continue re-issuable till the end of three years from the date; the penalty on each fraud in the business being 50*l.* The penalty on issuing promissory notes for the payment of money to the bearer on demand, with printed dates, is 50*l.* Notes re-issuable for a limited period are to be cancelled, on payment afterwards; and notes not re-issuable are to be cancelled immediately on payment. The penalty for re-issuing notes, &c. contrary to law, and for not cancelling them, is 50*l.*: the penalty for taking notes, &c. re-issued contrary to law, is 20*l.* However, notes and bills of the bank of England are exempted from stamp-duty; and any such notes may be re-issued after payment, as often as it shall be thought fit. The composition annually payable by the governor and company of the bank of England, for the duties on their bills and notes, is the sum of 3500*l.* for every million, and after that rate for half a million, but not for a less sum than half a million, of the said averagement or value of their said notes and bank post-bills in circulation: but when the governor and company resume their payments in cash, a new averagement for the composition on account of stamp-duties shall be submitted to parliament. It is also enacted, that the bank of Scotland, and royal bank of Scotland, and British linen company, may issue small notes on unstamped paper, accounting for the duties.

It is further enacted, that re-issuable notes are not to be issued by bankers or others, without a licence; which licences are subject to certain regulations, specified in the act. But no banker shall take out more than four licences for any number of towns in Scotland. Several towns in England may, in certain cases, be included in one licence. Persons applying for licences are to deliver specimens of their notes; and the penalty for issuing notes without licence is 100*l.*

It is enacted, that promissory notes made out of Great Britain are not to be negociable, unless stamped; and the penalty on circulating such notes is 20*l.* for each.

The duty on fire-insurances is to be collected by the companies undertaking the same, who shall render to the commissioners of stamps quarterly accounts, making up such accounts to their own quarter-days. These companies have an allowance for collecting the duties of 4*l.* per cent. at the head office in London or Westminster, and of 5*l.* per cent. elsewhere.

The penalty, by this act, for not proving wills, or taking letters of administration within a given time, *viz.* six calendar months after the decease of any person, or two calendar months after the termination of any depending suit, is a forfeiture of 100*l.*, and 10*l.* per cent. on the duty. Ecclesiastical courts are forbidden to grant probates or letters of administration, without affidavit of the value of effects; and such affidavits are to be free of stamp-duty, and to be trans-

mitted to commissioners of stamps; the penalty for neglect being 50*l.* Provision is made for adjusting the stamp-duty, when it is either too high or too low. The penalty on executors, &c. for not paying the full duty on probates, &c. within a given time after discovery of a deficiency, is 100*l.*, and 10 per cent. on the deficient duty. The commissioners of stamps may give credit for the duty on probates and letters of administration, in certain circumstances; and may extend the credit, if necessary. A return of duty on probates, &c. is to be made in respect of debts, if claimed within three years.

Articles of confessionary are exempted from stamps, unless they be avowedly sold as medicines. The money accruing from all the duties arising from this act is to be paid to the receiver-general, and by him into the exchequer.

The schedule belonging to this act consists of three parts; the *first* containing the duties on admissions to offices, &c.; on instruments of conveyance, contract, obligation, and security for money; on deeds in general; and on other instruments not included under the following heads. The *second* part contains the duties on law proceedings. The *third* part contains the duties on probates of wills and letters of administration; on confirmations of testaments; on inventories to be exhibited in the commissary courts of Scotland; on legacies out of real or personal, heritable or moveable estates; and on successions to personal or moveable estates upon intestacy. Out of this mass of matter we shall content ourselves with selecting those articles that are most common and most interesting; referring for those of more rare occurrence, or of less general interest, to the act itself.

Under the *first* part we shall begin with the duty on the admission of any person to act as an advocate in any of the ecclesiastical courts, or in the high court of admiralty, or in any of the courts of justice in Scotland, which is 50*l.*; and the same sum on the admission of any person to the degree of barrister at law in either of the inns of court in England. On admission of any person to act as an attorney, solicitor, or proctor, in any court in England; or as a sworn clerk, clerk in court, or other clerk or officer in any court in England, whose business and emoluments depend, like those of an attorney or solicitor, on his being retained and employed by clients or suitors, the duty is 25*l.* These duties are subject to certain regulations, which we shall not detail. The same sum is also payable on the admission of any person to act as a writer to the signet, or as a solicitor, &c. in any court in Scotland. For the admission of any person to act as a solicitor, &c. in the court of session, judiciary, or commission of teinds in Scotland, who shall not have served a clerkship for five years, to a writer to the signet, or a solicitor, under regular articles, which shall have paid the stamp-duty payable by law, his admission shall be charged with a further duty of 60*l.*; and if any person be admitted to act as a procurator or solicitor in the high court of admiralty in Scotland, the commissary court, or any inferior court in Scotland, without having served a five years' clerkship or apprenticeship, &c. he shall be charged with a further duty of 30*l.* These payments are subject to certain exemptions. For admission of any person as a writer in ordinary in chancery, or as one of the six clerks, or one of the curators of the court of chancery in England, or as a sworn clerk, &c. in any court in Great Britain, the duty, where the salary, fees, &c. shall not amount to 50*l.* a year, is 2*l.*; between 50*l.* and 100*l.*, 4*l.*; from 100*l.* to 200*l.*, 6*l.*; from 200*l.* to 300*l.*, 12*l.*; from 300*l.* to 500*l.*, 25*l.*; from 500*l.* to 750*l.*, 35*l.*; from 750*l.* to 1000*l.*, 50*l.*; from 1000*l.* to 1500*l.*, 75*l.*; from 1500*l.* to 2000*l.*, 100*l.*; from 2000*l.* to 3000*l.*, 150*l.*; and from 3000*l.* upwards, 200*l.* The duty for admission

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million as a notary public in England, is 3*l.*; and in Scotland, 2*l.*; for admission to be a member of either of the four inns of court in England, 25*l.*; into either of the societies called inns of chancery, 3*l.*; into the college of physicians in England or Scotland, 25*l.*; as a licentiate, 15*l.*; on matriculation in either of the English universities, 1*l.*; to the degree of a bachelor of arts in either English university, 3*l.* when conferred in ordinary course, and 5*l.* when conferred by special grace, or royal mandate, or by reason of nobility, or out of the ordinary course; to any other degree in either English university, for registry, in the ordinary course, 6*l.*, out of such course, 1*l.*; to the degree of doctor of medicine in either of the universities of Scotland, 1*l.*

For the admission of any person into any corporation, in respect of birth, apprenticeship, or marriage, the duty is 1*l.*; but upon any other ground, 3*l.* For an affidavit, the stamp-duty is 2*s.* 6*d.*, subject to various exemptions. For an agreement, or memorandum of the same, made in England under hand only, or in Scotland without any clause of registration, on a matter of the value of 2*l.*, or upwards, containing no more than 1080 words, 1*l.*; for more than 1080 words, 1*l.* 15*s.*; and for every quantity of 1080 words after the first, a progressive duty of 1*l.* 5*s.* This duty is subject to several general exemptions.

On the appointment of a chaplain, empowering to hold two ecclesiastical benefices in England, the duty is 2*l.*; on the appointment or deputation of a game-keeper, 1*l.* 15*s.* On the appraisement or valuation of any estate or effects, or any interest therein, or its annual value, or of any dilapidation, or of any repairs, &c. if the valuation shall not exceed 5*l.*, 2*s.* 6*d.*; from 5*l.* to 10*l.*, 5*s.*; from 10*l.* to 20*l.*, 10*s.*; from 20*l.* to 50*l.*, 15*s.*; and above 50*l.*, 1*l.* For the indenture of apprenticeship or clerkship (articles of clerkship to attorneys excepted), when the sum of money paid to the master or mistress shall not amount to 3*l.*, 1*l.*; from 3*l.* to 5*l.*, 2*l.*; from 5*l.* to 10*l.*, 3*l.*; from 10*l.* to 20*l.*, 6*l.*; from 20*l.* to 30*l.*, 12*l.*; from 30*l.* to 40*l.*, 20*l.*; from 40*l.* to 50*l.*, 25*l.*; from 50*l.* to 60*l.*, 30*l.*; from 60*l.* to 80*l.*, 40*l.*; from 80*l.* to 100*l.*, 50*l.*; from 100*l.* and upwards, 60*l.* For an indenture, without any consideration to the master or mistress, containing more than 1080 words, 1*l.*; and for more than that quantity, 1*l.* 15*s.* These indentures are subject to exemptions in favour of poor children apprenticed. For articles of clerkship, in order to admission as an attorney or solicitor in any of his majesty's courts at Westminster, 120*l.*; in any of the courts of the great sessions in Wales, or of the counties palatine of Chester, Lancaster, and Durham, or in any other court of record in England, holding pleas, in which the debt or damage amounts to 40*s.*, 60*l.*; and for any duplicate of such articles, 1*l.* 15*s.* With a view to admission as a sworn clerk in the office of the six clerks, or as a sworn clerk, &c. in the office of pleas, &c. in England, 120*l.*; and for any duplicate, 1*l.* 15*s.* For articles of clerkship, in order to admission as a proctor, 120*l.*; and for a duplicate, 1*l.* 15*s.* For indenture of clerkship, in order to admission as a writer to the signet, or solicitor in any of the courts of session, &c. in Scotland, 60*l.*; and for a duplicate, 1*l.* 15*s.* For indenture of clerkship, in order to admission to act as a procurator or solicitor in the high court of admiralty, the commissary court at Edinburgh, or any other inferior court in Scotland, 30*l.*; and for any duplicate, 1*l.* 15*s.*

For an inland bill of exchange, on demand or otherwise, not exceeding two months after date, or 60 days after sight, the duty for any sum amounting to 40*s.*, and not exceeding

5*l.* 5*s.*, is 1*s.*; from 5*l.* 5*s.* to 20*l.*, 1*s.* 6*d.*; from 20*l.* to 30*l.*, 2*s.*; from 30*l.* to 50*l.*, 2*s.* 6*d.*; from 50*l.* to 100*l.*, 3*s.* 6*d.*; from 100*l.* to 200*l.*, 4*s.* 6*d.*; from 200*l.* to 300*l.*, 5*s.*; from 300*l.* to 500*l.*, 6*s.*; from 500*l.* to 1000*l.*, 8*s.* 6*d.*; from 1000*l.* to 2000*l.*, 12*s.* 6*d.*; from 2000*l.* to 3000*l.*, 15*s.*; and exceeding 3000*l.*, 1*l.* 5*s.* For an inland bill of exchange, to bearer or order, exceeding two months after date, or 60 days after sight, for any sum from 40*s.* to 5*l.* 5*s.*, 1*s.*; from 5*l.* 5*s.* to 20*l.*, 2*s.*; from 20*l.* to 30*l.*, 2*s.* 6*d.*; from 30*l.* to 50*l.*, 3*s.* 6*d.*; from 50*l.* to 100*l.*, 4*s.* 6*d.*; from 100*l.* to 200*l.*, 5*s.*; from 200*l.* to 300*l.*, 6*s.*; from 300*l.* to 500*l.*, 8*s.* 6*d.*; from 500*l.* to 1000*l.*, 12*s.* 6*d.*; from 1000*l.* to 2000*l.*, 15*s.*; from 2000*l.* to 3000*l.*, 1*l.* 5*s.*; and above 3000*l.*, 1*l.* 10*s.* The duty for a foreign bill of exchange, drawn singly and not in a set, the same duty as on an inland bill of the same amount and tenor. The duty on foreign bills of exchange, drawn in sets according to the custom of merchants, is for every bill of each set, where the sum made payable doth not exceed 100*l.*, 1*s.* 6*d.*; from 100*l.* to 200*l.*, 3*s.*; from 200*l.* to 500*l.*, 4*s.*; from 500*l.* to 1000*l.*, 5*s.*; from 1000*l.* to 2000*l.*, 7*s.* 6*d.*; from 2000*l.* to 3000*l.*, 10*s.*; and for more than 3000*l.*, 15*s.* The bills exempt from the preceding and all other stamp-duties, are those issued by the governor and company of the bank of England, navy-bills, bills for the pay and allowances of his majesty's land forces, and some others. (See PROMISSORY Notes.) A bill of lading is chargeable with a duty of 3*s.* A bond in England, and personal bond in Scotland, given as a security for the payment of any definite sum of money, is chargeable, when the sum does not exceed 50*l.*, with a duty of 1*l.*; from 50*l.* to 100*l.*, 1*l.* 10*s.*; from 100*l.* to 200*l.*, 2*l.*; from 200*l.* to 300*l.*, 3*l.*; from 300*l.* to 500*l.*, 4*l.*; from 500*l.* to 1000*l.*, 5*l.*; from 1000*l.* to 2000*l.*, 6*l.*; from 2000*l.* to 3000*l.*, 7*l.*; from 3000*l.* to 4000*l.*, 8*l.*; from 4000*l.* to 5000*l.*, 9*l.*; from 5000*l.* to 10,000*l.*, 12*l.*; from 10,000*l.* to 15,000*l.*, 15*l.*; from 15,000*l.* to 20,000*l.*, 20*l.*; and exceeding 20,000*l.*, 25*l.* For a bond in England, and a personal bond in Scotland, given as a security for the transfer, or re-transfer of any share in any of the government parliamentary stocks or funds, or in the stock and funds of the bank of England, or East India company, or of the South-sea company, the duty is the same as on a bond for a sum of money, equal to the value of the stock or fund secured, according to its average price, on the day of the date of the bond, or on either of the ten days preceding.

For a bond in England, and personal and heritable bond in Scotland, given as a security for the payment of any annuity, except upon the original creation and sale thereof, or of any sum or sums of money at stated periods, not being interest for any principal sum, nor rent reserved or payable upon any lease or tack, for any definite and certain term, so that the total amount of the money to be paid can be previously ascertained, the same duty as on a bond of the like nature, for the payment of a sum of money equal to such total amount. For a similar bond, for the payment of an annuity, &c. for any indefinite period, or the term of life, so that the whole money to be paid cannot be previously ascertained, if the annuity, or sums secured, shall not amount to 1*l.* per annum, 1*l.*; from 1*l.* to 50*l.* per annum, 2*l.*; from 50*l.* to 100*l.*, 3*l.*; from 100*l.* to 200*l.*, 4*l.*; from 200*l.* to 300*l.*, 5*l.*; from 300*l.* to 400*l.*, 6*l.*; from 400*l.* to 500*l.*, 7*l.*; from 500*l.* to 750*l.*, 9*l.*; from 750*l.* to 1000*l.*, 12*l.*; from 1000*l.* to 1500*l.*, 15*l.*; from 1500*l.* to 2000*l.*, 20*l.*; and from 2000*l.* per annum and upwards, 25*l.* The duties on various kinds of bonds

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are subject to various exemptions and regulations, for which we refer to the statute. For a yearly certificate taken out by every person admitted as an attorney or solicitor, and as a proctor, in England, and by every person admitted as a writer to the signet, solicitor, agent, attorney, or procurator, in any of the courts of Scotland; and by every sworn clerk, &c. and any other clerk or officer in any of the courts aforesaid, who shall act, in expectation of any fee or reward, as an attorney, solicitor, agent, proctor, procurator, or notary public, though not admitted or enrolled as such, if he shall reside in the city of London, or city of Westminster, or within the limits of the two-penny post in England, or within the city or shire of Edinburgh, who has been in possession of his office for three years or upwards, 12*l.*, or if he has not been in possession so long, 6*l.*; or if he shall reside elsewhere, in the first circumstance above stated, 8*l.*, and in the second, 4*l.* For a certificate taken out yearly by a member of one of the four inns of court in England, who acts as a conveyancer, special pleader, draftsman in equity, or otherwise, if he shall reside in the city of London, &c. as before stated, 12*l.*; or if he shall reside elsewhere, 8*l.* The exemptions comprehend sergeants at law and barristers; attorneys, solicitors, proctors, and notaries public; and other persons acting as such by virtue of any office or appointment, taking out certificates in these characters; and public officers preparing deeds, &c. by virtue of their office. A certificate of marriage, that of any common seaman, marine, or soldier excepted, is chargeable with a duty of 5*s.*; and so is the certificate of a person's having received the holy sacrament. The duty upon a charter-party is 1*l.* 15*s.*; that upon collation by an archbishop or bishop to any ecclesiastical benefice or promotion of 10*l.* or upwards yearly value in the king's books, is 20*l.*; that of collation to any other ecclesiastical benefice, &c. in England, is 10*l.*; that of collation, or admission by any presbytery or competent authority, to any ecclesiastical benefice in Scotland, is 2*l.* For the duties on different kinds and modes of conveyance, see the statute. The duty on a debenture or certificate for entitling a person to receive a drawback of duties in the customs or excise, or bounty payable out of the revenue of either, if the same shall not exceed 100*l.*, is 5*s.*; from 100*l.* to 200*l.*, 10*s.*; from 200*l.* to 500*l.*, 1*l.*; and above 500*l.*, 2*l.* For a declaration of trust, &c. the duty is 1*l.* 15*s.* For every skin or piece of vellum, &c. upon which shall be written the exemplification or constat under the great seal of the united kingdom of Great Britain and Ireland, of any letters patent or grant, the duty is 5*l.*

For a faculty from the archbishop of Canterbury, or the master of the faculties for the time being, or from the guardian of the spiritualities during a vacancy of the archbishop's see, not otherwise charged, the duty is 30*l.* For a grant or letters patent under the great seal, or the seal of the county palatine of Lancaster, or the seal kept and used in Scotland, of the honour or dignity of a duke, 350*l.*; of a marquis, 300*l.*; of an earl, 250*l.*; of a viscount, 200*l.*; of a baron, 150*l.*; of a baronet, 100*l.*; of a congé d'elire for any dean and chapter, for the election of an archbishop or bishop, 30*l.*; of the royal assent to or signification of such election, or of the nomination and presentation by his majesty, in default of such election, of any person to be an archbishop or bishop, 30*l.*; of or for the restitution of the temporalities to any archbishop or bishop, 30*l.*; of any other honour or franchise, &c. to any person or persons, body or bodies politic or corporate, 30*l.*; and if such grant or letters patent are contained in more than one skin, piece of

vellum, &c., then for every skin, sheet, or piece thereof, after the first, a progressive duty of 20*l.* For a grant or warrant of precedence to take rank among nobility, under his majesty's sign manual, 100*l.*; for a grant or licence, under the sign manual, to take and use a surname and arms, or a surname only, in compliance with any will or settlement, 50*l.*; for arms to the same, on voluntary application, 10*l.*; and for grant of arms, or armorial ensigns only, 10*l.* For a grant, under the great seal, &c. of any definite sum of money, not amounting to 100*l.*, 1*l.* 10*s.*; from 100*l.* to 250*l.*, 4*l.*; from 250*l.* to 500*l.*, 10*l.*; from 500*l.* to 750*l.*, 20*l.*; from 750*l.* to 1000*l.*, 30*l.*; from 1000*l.* and upwards, for every 500*l.*, 5*l.*

The duty on a grant of any annuity or pension, not amounting to 100*l.* per annum, is 1*l.* 10*s.*; from 100*l.* to 200*l.*, 4*l.*; from 200*l.* to 400*l.*, 10*l.*; from 400*l.* to 600*l.*, 20*l.*; from 600*l.* to 800*l.*, 30*l.*; from 800*l.* to 1000*l.*, 40*l.*; from 1000*l.* and upwards, 50*l.* For his majesty's grant of any office or employment, by letters patent, deed, or other writing, the profits of which do not amount to 50*l.* per annum, 2*l.*; from 50*l.* to 100*l.*, 4*l.*; from 100*l.* to 200*l.*, 6*l.*; from 200*l.* to 300*l.*, 12*l.*; from 300*l.* to 500*l.*, 25*l.*; from 500*l.* to 750*l.*, 35*l.*; from 750*l.* to 1000*l.*, 50*l.*; from 1000*l.* to 1500*l.*, 75*l.*; from 1500*l.* to 2000*l.*, 100*l.*; from 2000*l.* to 3000*l.*, 150*l.*; from 3000*l.* and upwards, 200*l.*

For institution to any ecclesiastical benefice in England upon presentation, 2*l.*; upon petition of the patron to be admitted, if the benefice or promotion be of the yearly value of 10*l.* and upwards in the king's books, 30*l.*; or if the same shall be of any other description, 15*l.*

The duty on a letter of attorney, made by a petty officer, seaman, marine, or soldier serving as a marine, for receiving prize money, is 1*s.*, for receiving wages, 1*l.* For a letter of attorney for the sale, transfer, acceptance, or receipt of dividends in any of the government stocks or funds, 1*l.*; for that of any other kind, or commission or factory, 1*l.* 10*s.*; and if more than 1080 words be used, a progressive duty for every 1080 words, after the first, of 1*l.* For a letter of licence from creditors to a debtor, the duty is 1*l.* 15*s.*; and a progressive duty for every 1080 words above the first number, of 1*l.* 5*s.*: for letters of marque and reprisal, 5*l.*: for licence for marriage in England, if special, 5*l.*; if not special, 10*s.*: for licence to use the occupation of an appraiser, taken out yearly, 10*s.*: for a banker or any other person who shall issue any promissory notes for money payable to the bearer on demand, and allowed to be re-issued, 30*l.*: for exercising the trade of a pawnbroker within the cities of London and Westminster, or within the limits of the two-penny post, 15*l.*; and elsewhere, 7*l.* 10*s.* For policy of assurance on life or lives, if the sum insured shall not amount to 500*l.*, 1*l.*; from 500*l.* to 1000*l.*, 2*l.*; from 1000*l.* to 3000*l.*, 3*l.*; from 3000*l.* to 5000*l.*, 4*l.*; from 5000*l.* and upwards, 5*l.* For policy of insurance from loss or damage by fire to goods, &c. 3*s.* per cent. per annum. For policy of insurance on any ship or vessel, or any goods on board, &c. where the premium shall not exceed the rate of 20*s.* per cent. on the sum insured, if the whole sum does not exceed 100*l.*, the stamp-duty is 1*s.* 3*d.*; if the whole sum shall exceed 100*l.*, then for every 100*l.*, and also for any fractional part of 100*l.*, 1*s.* 3*d.*; and where the premium shall exceed the rate of 20*s.* per cent. on the sum insured, if the whole sum insured shall not exceed 100*l.*, 2*s.* 6*d.*; if it shall exceed 100*l.*, then for every 100*l.*, and also for any fractional part of 100*l.*, 2*s.* 6*d.* If the insurance be made upon any ship or vessel, or goods, or freight, for any other voyage besides that above mentioned,

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tioned, from any part in the united kingdom or the adjacent islands, to any other part in the said kingdom or islands, or for any certain term or period of time not exceeding twelve calendar months, if the premium be 20s. *per cent.* on the sum insured, and the whole sum do not exceed 100*l.*, the duty is 2*s.* 6*d.*; but if it shall exceed 100*l.*, then for every 100*l.*, and for any fractional part, 2*s.* 6*d.*: and if the premium exceed 20s. *per cent.* on the sum insured, if the whole sum shall not exceed 100*l.*, the duty is 5*s.*; and if it shall exceed 100*l.*, then for every 100*l.*, and any fractional part of 100*l.*, of which the same shall consist, 5*s.*

For a presentation by his majesty, or by any patron, to any ecclesiastical benefice, &c. of the yearly value of 10*l.* or upwards in the king's books, the duty is 20*l.*; and to any other ecclesiastical benefice or promotion in England, 10*l.* For a deed of procuration, 1*l.* 10*s.* Of PROMISSORY Notes we have already given an account under that article; but the act, the provisions of which we are now reciting, has repealed the 48th of Geo. III. and made some addition to the stamp-duties. The note for payment of any sum of money to the bearer on demand is chargeable, for 1*l.* 1*s.* with a duty of 5*d.*; from 1*l.* 1*s.* to 2*l.* 2*s.* with 10*d.*; from 2*l.* 2*s.* to 5*l.* 5*s.* with 1*s.* 3*d.*; from 5*l.* 5*s.* to 10*l.*, with 1*s.* 9*d.*; from 10*l.* to 20*l.*, with 2*s.*; from 20*l.* to 30*l.*, with 3*s.*; from 30*l.* to 50*l.*, with 5*s.*; from 50*l.* to 100*l.*, with 8*s.* 6*d.* The promissory note for payment in any other manner, &c. but not exceeding two months after date, or 60 days after sight, from 40*s.* to 5*l.* 5*s.*, is chargeable with a duty of 1*s.*; from 5*l.* 5*s.* to 20*l.*, 1*s.* 6*d.*; from 20*l.* to 30*l.*, 2*s.*; from 30*l.* to 50*l.*, with 2*s.* 6*d.*; from 50*l.* to 100*l.*, with 3*s.* 6*d.* Those notes either to the bearer on demand, or in any other manner, but not exceeding two months after date, or 60 days after sight, are chargeable, from 100*l.* to 200*l.*, with a duty of 4*s.* 6*d.*; from 200*l.* to 300*l.*, with 5*s.*; from 300*l.* to 500*l.*, 6*s.*; from 500*l.* to 1000*l.*, 8*s.* 6*d.*; from 1000*l.* to 2000*l.*, 12*s.* 6*d.*; from 2000*l.* to 3000*l.*, with 15*s.*; above 3000*l.* with 1*l.* 5*s.* Those payable at any time exceeding two months after date, or 60 days after sight, from 40*s.* to 5*l.* 5*s.*, are chargeable with a duty of 1*s.* 6*d.*; from 5*l.* 5*s.* to 20*l.*, 2*s.*; from 20*l.* to 30*l.*, 2*s.* 6*d.*; from 30*l.* to 50*l.*, 3*s.* 6*d.*; from 50*l.* to 100*l.*, 4*s.* 6*d.*; from 100*l.* to 200*l.*, 5*s.*; from 200*l.* to 300*l.*, 6*s.*; from 300*l.* to 500*l.*, 8*s.* 6*d.*; from 500*l.* to 1000*l.*, 12*s.* 6*d.*; from 1000*l.* to 2000*l.*, 15*s.*; from 2000*l.* to 3000*l.*, 1*l.* 5*s.*; exceeding 3000*l.*, 1*l.* 10*s.* (See PROMISSORY Notes.) For protest of a bill of exchange or promissory note, for any sum under 20*l.*, 2*s.*; from 20*l.* to 100*l.*, 3*s.*; from 100*l.* to 500*l.*, 5*s.*; from 500*l.* upwards, 10*s.* For every sheet on which a protest is written, after the first, a progressive duty of 5*s.* For receipts from 2*l.* to 5*l.*, 2*d.*; from 5*l.* to 10*l.*, 3*d.*; from 10*l.* to 20*l.*, 6*d.*; from 20*l.* to 50*l.*, 1*s.*; from 50*l.* to 100*l.*, 1*s.* 6*d.*; from 100*l.* to 200*l.*, 2*s.* 6*d.*; from 200*l.* to 300*l.*, 4*s.*; from 300*l.* to 500*l.*, 5*s.*; from 500*l.* to 1000*l.*, 7*s.* 6*d.*; from 1000*l.* upwards, 10*s.*; and in full of all demands, 10*s.* (See RECEIPT.) For settlement upon or for the benefit of any person or persons, in possession or reversion, if the sum shall not amount to 1000*l.*, the duty is 1*l.* 15*s.*; from 1000*l.* to 2000*l.*, 2*l.*; from 2000*l.* to 3000*l.*, 3*l.*; from 3000*l.* to 4000*l.*, 4*l.*; from 4000*l.* to 5000*l.*, 5*l.*; from 5000*l.* to 7000*l.*, 7*l.*; from 7000*l.* to 9000*l.*, 9*l.*; from 9000*l.* to 12,000*l.*, 12*l.*; from 12,000*l.* to 15,000*l.*, 15*l.*; from 15,000*l.* to 20,000*l.*, 20*l.*; from 20,000*l.* and upwards, 25*l.* For testimonial or certificate of the admission of any person to the degree of bachelor of arts, in either of the English universities, 3*l.*; to any other degree, 10*l.* For transfer of any share in

bank stock, or South-sea stock, 7*s.* 9*d.*; in the stock of the East India company, 1*l.* 10*s.*; in the stock of any other corporation, company, or society, 1*l.* 10*s.*

For an account of the second part of the schedule annexed to the 55th Geo. III. c. 184. containing the duties on law proceedings, we refer to the act itself.

The third part contains the duties on probates of wills and letters of administration, on confirmations of testaments, inventories, legacies, and successions. The duties on probates of a will, and letters of administration with a will annexed, to be granted in England, confirmation of any testament and inventory to be recorded in any commissary court in Scotland, by the 55th Geo. III. which alters the amounts stated from 48 Geo. III. under PROBATE, are shewn in the following table:

	£	£	£	s.	d.
From	20	to	100	0	10 0
—	100	—	200	2	0 0
—	200	—	300	5	0 0
—	300	—	450	8	0 0
—	450	—	600	11	0 0
—	600	—	800	15	0 0
—	800	—	1,000	22	0 0
—	1,000	—	1,500	30	0 0
—	1,500	—	2,000	40	0 0
—	2,000	—	3,000	50	0 0
—	3,000	—	4,000	60	0 0
—	4,000	—	5,000	80	0 0
—	5,000	—	6,000	100	0 0
—	6,000	—	7,000	120	0 0
—	7,000	—	8,000	140	0 0
—	8,000	—	9,000	160	0 0
—	9,000	—	10,000	180	0 0
—	10,000	—	12,000	200	0 0
—	12,000	—	14,000	220	0 0
—	14,000	—	16,000	250	0 0
—	16,000	—	18,000	280	0 0
—	18,000	—	20,000	310	0 0
—	20,000	—	25,000	350	0 0
—	25,000	—	30,000	400	0 0
—	30,000	—	35,000	450	0 0
—	35,000	—	40,000	525	0 0
—	40,000	—	45,000	600	0 0
—	45,000	—	50,000	675	0 0
—	50,000	—	60,000	750	0 0
—	60,000	—	70,000	900	0 0
—	70,000	—	80,000	1,050	0 0
—	80,000	—	90,000	1,200	0 0
—	90,000	—	100,000	1,350	0 0
—	100,000	—	120,000	1,500	0 0
—	120,000	—	140,000	1,800	0 0
—	140,000	—	160,000	2,100	0 0
—	160,000	—	180,000	2,400	0 0
—	180,000	—	200,000	2,700	0 0
—	200,000	—	250,000	3,000	0 0
—	250,000	—	300,000	3,750	0 0
—	300,000	—	350,000	4,500	0 0
—	350,000	—	400,000	5,250	0 0
—	400,000	—	500,000	6,000	0 0
—	500,000	—	600,000	7,500	0 0
—	600,000	—	700,000	9,000	0 0
—	700,000	—	800,000	10,500	0 0
—	800,000	—	900,000	12,000	0 0
—	900,000	—	1,000,000	13,500	0 0
—	1,000,000	and upwards		15,000	0 0

For

For letters of administration, without a will annexed, to be granted in England, and also confirmation and inventory in Scotland, the duties are as follow:

From	£	to	£	£	s.	d.
—	20	—	50	0	10	0
—	50	—	100	1	0	0
—	100	—	200	3	0	0
—	200	—	300	8	0	0
—	300	—	450	11	0	0
—	450	—	600	15	0	0
—	600	—	800	22	0	0
—	800	—	1,000	30	0	0
—	1,000	—	1,500	45	0	0
—	1,500	—	2,000	60	0	0
—	2,000	—	3,000	75	0	0
—	3,000	—	4,000	90	0	0
—	4,000	—	5,000	120	0	0
—	5,000	—	6,000	150	0	0
—	6,000	—	7,000	180	0	0
—	7,000	—	8,000	210	0	0
—	8,000	—	9,000	240	0	0
—	9,000	—	10,000	270	0	0
—	10,000	—	12,000	300	0	0
—	12,000	—	14,000	330	0	0
—	14,000	—	16,000	375	0	0
—	16,000	—	18,000	420	0	0
—	18,000	—	20,000	465	0	0
—	20,000	—	25,000	525	0	0
—	25,000	—	30,000	600	0	0
—	30,000	—	35,000	675	0	0
—	35,000	—	40,000	785	0	0
—	40,000	—	45,000	900	0	0
—	45,000	—	50,000	1,010	0	0
—	50,000	—	60,000	1,125	0	0
—	60,000	—	70,000	1,350	0	0
—	70,000	—	80,000	1,575	0	0
—	80,000	—	90,000	1,800	0	0
—	90,000	—	100,000	2,025	0	0
—	100,000	—	120,000	2,250	0	0
—	120,000	—	140,000	2,700	0	0
—	140,000	—	160,000	3,150	0	0
—	160,000	—	180,000	3,600	0	0
—	180,000	—	200,000	4,050	0	0
—	200,000	—	250,000	4,500	0	0
—	250,000	—	300,000	5,625	0	0
—	300,000	—	350,000	6,750	0	0
—	350,000	—	400,000	7,875	0	0
—	400,000	—	500,000	9,000	0	0
—	500,000	—	600,000	11,250	0	0
—	600,000	—	700,000	13,500	0	0
—	700,000	—	800,000	15,750	0	0
—	800,000	—	900,000	18,000	0	0
—	900,000	—	1,000,000	20,250	0	0
—	1,000,000	and upwards		22,500	0	0

For an account of legacies and successions, as under the article RECEIPT, Schedule, part iii. with the following alteration agreeably to 55 Geo. III. c. 184; inserting instead of 10th October 1808, the 31st day of August 1815; inserting also in col. 2. line 13 from the bottom, after "deceased," or the father or mother, or any lineal ancestor of the deceased; instead of 2*l.* 10*s.* — 3*l.*; instead of 4*l.* — 5*l.*, and instead of 5*l.* — 6*l.*

STAMP-Office, an office under the direction of six commissioners, who are empowered to substitute inferior officers for the management of the stamp-duties. (5 Will. cap. 21.

9 & 10 Will. c. 25.) To this office belong a receiver-general, a comptroller, a secretary, and a number of clerks, &c. &c.

STAMPALIA, or STAMPALÆA, in *Geography*, formerly *Alypalea*, properly signifying the ancient city, and called also *Pyrrha*, *Pilea*, and at length *Theon Trabeza*, i. e. the table of the gods, because its soil is fertile, and it is almost every where enamelled with flowers, an island of the Archipelago, which, in the time of Pliny, was an independent country, and where Achilles had a temple, and that sort of worship that was paid to valour, contributed to maintain among its inhabitants the energy necessary for people who are not willing to submit to the yoke of a conqueror. From the irregular form of this island, it might be called the "Indented Island;" its shores presenting a variety of points, or sinuosities, that form so many coves and bays fit for the anchorage of ships or boats, though we can scarcely reckon more than two harbours, the one to the south, the other to the north. It is about six leagues in length, and only two in its greatest breadth; it is not very lofty, nor has it any high mountains that can be discovered at a great distance. Its soil, as we have already said, is fertile, being of that kind which is observed on plains and hills, and which does not extend to the tops of steep mountains. Stampalia is reckoned one of the most fertile islands of the Archipelago: its inhabitants experience the mildness of the climate and the goodness of the soil; and in these respects they differ in character from the rough islanders of Calamo and Lero, which are rugged countries. Its fertility, however, is checked by the empire of the Turks, to which it is subject; and the oppressive exactions to which its inhabitants are compelled to submit: the shores abound with a great variety of fish. N. lat. 36° 40'. E. long. 26° 16'.

STAMPE, or TEMPÉ, in *Commerce*, a small copper coin in the West India islands. In the English Leeward islands 1 stampe = 1½ dog = 2¼*d.* Leeward currency, and 8 dogs or 4 stamperes = 1 bit = 9*d.* of the same currency; the dollar in this currency being reckoned at 9*s.* In the French islands, the noir or dog is = 2 fols 6 deniers = 1½*d.* Leeward currency, and the tempé or stampe = 3 fols 9 deniers = 2¼*d.* Leeward currency.

STAMPERS and STAMPING, in *Coinage*. See COIN and COINAGE.

STAMPING-MILL, or *Knocking-Mill*, an engine used in the tin-works to bruise the ore small.

STAMPS, in *Metallurgy*, a sort of large pestles lifted up by water-wheels, and serving to beat to powder the ores, and refuse of ores of metals.

STAMSLO, in *Geography*, a town of Hungary; 15 miles N.E. of Gros Wardein.

STAMWOOD, in *Agriculture*, a term applied to the roots of trees grubbed up. Any sorts of root-wood are so termed in different situations and places.

STANCH, or STAUNCH, a name given by the country people of Northamptonshire, and some other counties, to a species of fossil called felenites, from its supposed virtue in stopping fluxes of blood. See PACHODECARHOMBS.

STANCHING of Blood, the stopping of blood in cases of wounds in horses or other animals. This is mostly best performed by means of dossels of lint and tow applied to the parts which are wounded.

STANCHIO, or STANCHO, in *Geography*, an island in the Grecian Archipelago, anciently known by the name of *Cos* (which see), and by some modern geographers called "Lango." Of the ancient magnificence of this island no traces now remain. The modern town of Stancho

is small; its buildings are not particularly remarkable; though its situation on the sea-shore is the same with that of the ancient city, and its environs are still agreeable. It is surrounded by orchards of lemon and orange-trees, the flowers and fruit of which are equally regaling and refreshing to its inhabitants, and afford them a valuable article of commerce. Cargoes of oranges and lemons are shipped here, and conveyed to different parts of Turkey, but principally to Smyrna and Constantinople. The harbour, which is defended by a castle, kept in bad order, though formerly safe and deep, can no longer receive any but small vessels: large ships remain without, in a road which has good holding-ground, but in winter it is open to the winds, and the swell from the north and west, and therefore avoided. The population of the town of Stancho is in a great measure composed of Turks: the Greeks occupy the remaining part of the island, but they are not numerous. The island, which is much longer than it is broad, is not very extensive; but the beauty of its climate and of its soil, its fecundity, and its natural allurements, would render the paucity of its inhabitants extraordinary, if we did not recollect that it is under the immediate command of the Turks. Some writers have asserted that Stancho is an island subject to epidemical diseases, and dangerous to be inhabited: but Sonnini says, that this assertion is ill-founded. Stancho retains the high character for mildness of climate, richness of soil, and salubrity of the air, given by the ancients to Cos. Some very high mountains command the fourth part of the island: and navigators, desirous of a shelter from the impetuous northerly winds, find a propitious retreat in that quarter in the little harbour of Safodino. The remainder of the island is a beautiful plain, abounding with various fruits, such as oranges, lemons, figs, grapes, &c. which are delicious. The wine drawn from its grapes is delicate and agreeable. Its excellent pastures formerly fed numerous flocks, that furnished wool, with which the inhabitants manufactured stuffs, held in high estimation for their fineness, and also for the brilliant colours with which they were dyed. But this kind of industry and its benefits are lost. Its silk has also failed; though the climate is favourable to mulberry-trees, and the worm which feeds on them. Stancho is famous for a plane-tree, which covers the little public square in which it is found with its antique and twisting branches, and cools it with its impervious shade. Its thick branches are supported by pillars, or rather fragments of pillars, of marble and granite; and these pillars are the only ancient monuments which the island affords, if we except a few medals of little value. Under the shade of the plane-tree is a fountain, which supplies the Turks with water, and a coffee-house, which furnishes a beverage that serves them in lieu of wine and every other fermented liquor. It is not improbable, that ten centuries have elapsed since this tree was planted. N. lat. $36^{\circ} 46'$. E. long. $26^{\circ} 56'$. The bay of Stancho lies on the S.W. coast of Natolia, opposite to the island. N. lat. $36^{\circ} 48'$ to $37^{\circ} 4'$. E. long. $27^{\circ} 14'$ to $27^{\circ} 44'$.

STANCHIONS, in *Building*. See **PUNCHION**.

STANCHIONS, in a *Ship*, those small pillars of wood or iron which are used for various purposes; as to support the decks, the quarter-rails, the nettings, the awnings, &c. The first of these are two ranges of small columns fixed under the beams, throughout the ship's length between decks; one range being on the starboard, and the other on the larboard side of the hatchways. They are chiefly intended to support the weight of the artillery.

STANCHIONS of the Nettings, are either slender bars of iron, whose lower ends are fixed in iron sockets at proper

distances; or square wooden pillars, let into the upper part of the ship's side. See **QUARTER-Netting**.

STAND, STABLESTAND. See **STABLESTAND**.

STAND, in *Commerce*, a weight from two hundred and a half to three hundred of pitch.

STAND of Arms. See **ARMS**.

STAND, Bee, in *Rural Economy*, is constructed in the form and manner of a slight shed, and made of good seasoned wood, so framed, that the fore-part of the shed or stand may be about six or seven feet high, and the hind-part five or six. The top, and also the ends and back, must be well covered with strong boards. The inside should, likewise, have a lining of very thin deal-boards, and be furnished with strong shelves, so proportioned, as to suit the number of hives, boxes, or glasses, that are to be placed on them. And to the front, which should be open, thin shades of wood should be so formed and fixed up, that they may be raised or lowered, as may be necessary for the protection of the bees against either heat or moisture. See **HIVE**.

STAND, Grain or Corn, in *Agriculture*, the name of such as are made of framed wood, stones, low walls, or other contrivances, and which are raised for placing grain upon, in making it into stacks.

The most ordinary mode of forming these stands is merely that of placing two or three pieces of large timber lengthways, and then putting smaller ones cross-ways at the ends, filling up the middle parts with smaller pieces of wood or other materials. This is, however, a mode by no means to be generally employed, as it provides no security for the bottom of the stack. But in other cases, a strong framing of good timber is put upon posts of wood, or what is better, of stones, about two feet high, provided with round caps of good flat stones, and on these the stacks rest in a very solid and secure manner, and it affords a good and secure support for the corn.

These stack-stands are, however, much better when constructed wholly of stone, being built to the same height as in the former case, in a rather slanting manner outwards, and covered on the tops with copings of oak-planking or flat stones, which project over the edges several inches, and in that way prevent the depredations of rats and mice on the grain, as well as their lodging in the stacks. In both these modes, pieces of timber are placed as a frame in the middle, to support the grain upon.

Further, in constructing these stands, the foundation should be sunk a considerable depth into the ground, and the bottoms be well laid, to prevent vermin getting to the grain of the stacks by working under them; and no sort of substances should ever be suffered to rest against them, or the loose corn to hang down during the time of building the stacks. It is obvious that the form of these stands must vary according to that in which the stacks are to be made, which is different in different districts. The circular and oblong forms are the most usual; but the long narrow shape is probably to be preferred, as it is said, in the Agricultural Report of Northumberland, to keep the corn better, more dry, and freer from heating.

It has been remarked, that on brick or stone stands, stacks of the parallelogrammical form may be built to any size; but that for small stacks, especially where wood is employed, the octagonal form of stand should rather be preferred to the circular one, as the copings may be cut with less waste, and from smaller timber; and it is just as easy to build a circular stack on an octagonal stand as on a circular one. But that where stone can be easily procured, it is without

doubt the most proper material for the bottoms; and brick, when properly made for the purpose, answers very well, especially if proper care be taken in the laying of it. Slate is also another material, where it can be had at a reasonable expence, that may be a very good substance for this use. Likewise flag-stones would answer extremely well; but neither slates nor flag-stones are necessary, if the foundations be laid sufficiently deep to prevent the vermin burrowing under them. The celebrated Mr. Bakewell made use of stands of this kind with much advantage; and other farmers, in the same district, probably employed them before his time.

Several different forms of stands of this sort are employed on the farms of the duke of Bedford, at Woburn, and in other places. See *STACK*.

STAND, Hay, may be formed in somewhat the same manner as that for grain or corn, only it is seldom necessary to have it made of such expensive materials. A simple frame of wood is mostly sufficient, with proper bearers laid across for the support of the stack. See *STACK* and *STACKING of Hay*.

STANDARD, in *Commerce*, is a weight, measure, or coin, of acknowledged authority, by which others of the same denomination are sized, compared, or adjusted. (See *COIN, MEASURE, and WEIGHT*.) We shall begin this important article with *Measures*, and conclude with *Coins*, including the new standard weight for silver, of 1816.

When a standard for linear measure is once established, that for measures of capacity is easily deduced, by determining their cubic or solid contents; and from the latter, standard weights may be derived, as a vessel of any certain dimensions filled with pure water, at a given temperature, will always weigh the same in the same latitude.

It is, however, to be remarked, that this systematic mode of obtaining standards has been seldom adopted, as they seem to have been generally established at the will of individuals, or by the agreement of governments. Such are therefore called *arbitrary standards*, to distinguish them from *invariable standards from nature*; that is, measures obtained from some unalterable property of nature; as the dimensions of the earth, the motions of the heavenly bodies, or the laws of gravitation. These standards have been anxiously sought after by the first mathematicians of modern times; but before their labours and researches are described, it will be proper to give an account of the past and present state of arbitrary standards, which are those universally adopted, except in France.

The standard measures of linear extension of all countries appear, from their names, to have been originally taken from some part of the human body, as the foot, the fathom, &c. But as such must constantly vary with the different sizes of men, standards of some durable substance became necessary; and it may be observed, that in country places where such are not at hand, natural measures are still occasionally used, as the arm, the pace, &c. Hence some account of their proportions to each other cannot be uninteresting or foreign to our subject. The fathom is reckoned to equal the height or stature of a well-proportioned man: the pace is supposed to equal half of the stature, the cubit one-fourth, the foot one-sixth, and the span one-eighth. The breadth of the hand is reckoned one-third of the foot, that of the thumb one-twelfth, and of the finger one-eighteenth. Other proportions are occasionally used, which, however, are not considered so regular as the above; such are the head, the arm, and the girth, &c. The head is particularly noticed by painters and statuaries, who

reckon the symmetry good when the whole height equals seven heads: but it has been made to equal more than seven and a half heads in ancient figures intended to represent dignity or strength. The proportion, however, varies considerably among different races of men, and in different countries. The average of the European stature is from six to seven heads; but that of the Kalmucks, Samoyedes, Laplanders, &c. is seldom more than five heads, and frequently less.

From such an extraordinary variety may be traced the diversity of standard measures throughout the world. It has, however, been the endeavour of all regular governments to correct this inconvenience; and hence established standards have been, from the earliest period of history, objects of peculiar care. They have been deposited in the sanctuary of the Jews, the temples of the heathens, and the churches of the primitive Christians; and distinguished officers were always appointed to distribute copies of the same, to examine those in use, and to correct or condemn such as were found erroneous.

The Jews called their original standard *seabac*, and those copied from it, *mesurah baddin*, or judged measures. We frequently read in scripture of "the weight of the sanctuary," "the measure of the sanctuary," and "the shekel of the sanctuary." Numerous texts and precepts likewise occur in the sacred volume to command uniformity.

The Greeks called their standards *archetype*, *prototype*, and *metreon tropos*; and it is said, that at a very remote period they had but two standards, namely, the *Pythic* and the *Olympic* measures. At Athens, fifteen officers were constantly employed for the regulation of their standards. The ancient Romans likewise paid strict attention to the same object, and are said to have established one standard, called *mensura*, in every city throughout their vast dominions; and each of those measures was an accurate copy of the original, kept in the temple of Jupiter in the Capitol, which standard was therefore called *capitolina*.

It is stated by several good authorities, that the Egyptians gave standards at a very early period to the neighbouring countries of Asia and Greece, from measurements made of an arc of the meridian. It is observed by Pausanias, in his "Metrologie," that the base of their largest pyramid was made the principal standard, which was the 500th part of a degree of the meridian, previously measured for that purpose; and Bailly, in his "Astronomie Ancienne," asserts that the Egyptian computation of the degree nearly corresponds with the modern measurement of the same arc. However this may be, there is little doubt but that uniformity of standard measures was more strictly established among the ancients than among the moderns. The extensive and arbitrary power possessed by many ancient sovereigns must have greatly contributed to this. Even the Christian emperors were very strict in promoting uniformity, inasmuch that in the time of Charlemagne there was but one weight and one measure throughout his empire. In succeeding ages, however, a great diversity was introduced in France by the abuses of manorial rights and feudal tenures; and to similar causes may be ascribed much of that variety which still prevails in the different states of Italy, Germany, Spain, and most other countries of Europe.

These remarks naturally lead us to the consideration of the standards of our own country.

Standards of English Weights and Measures.—The standards of English weights and measures are supposed to be chiefly of Saxon origin, but their early history is very imperfectly known.

STANDARD.

Bishop Fleetwood observes, in his "Chronicum Preciosum," that "there were good laws made on the standards of weights and measures before the Conquest, by Edgar and Canute, but that they were never well observed." The same remark will indeed apply to many laws on the subject subsequent to that period.

Henry I. is said to have paid much attention to the regulation of weights and measures, and to have adjusted the Saxon *gyrd*, or girth, the modern yard, to the length of his arm. This standard he deposited in the Exchequer at Westminster, where it is still preserved. As to the standards of weights, they have undergone several alterations since that time. The troy weight, which is supposed to have taken its name from Troyes, in France, was introduced by the Normans, and contained at first 7680 grains, but was afterwards reduced to its present weight of 5760 grains. Before the reign of Henry VIII., the Tower or moneyer's pound was mostly used for the precious metals, and was 15 dwt. less than the troy pound. About the same period the avoirdupois weight was established for heavy goods, in the room of the old commercial weight, which latter is still retained in Scotland under the name of the *Amsterdam weight*; and it is worthy of remark, that the assize of bread in England has been constantly fixed according to this ancient weight by the magistrates; the peck loaf newly baked being 16 lb. Amsterdam weight, which answers to 17 lb. 6 oz. avoirdupois.

Several standards of weights and measures were anciently kept at Winchester, from whence our corn-bushel derives its name; but in later times they have been chiefly kept in the Exchequer, at Guildhall, and at the Tower.

Present State of English Standards.—In the year 1758, the house of commons appointed a select committee to enquire into the original standards of weights and measures, and to report accordingly. They were assisted in their researches by several eminent mathematicians and mechanists, who pursued the enquiry with great system and ability. Their report, which is very elaborate, contains the results of numerous trials and comparisons made on the several standards kept at the Exchequer and at Guildhall, which results were by no means satisfactory, particularly with regard to measures of capacity. Their labours, however, were not merely confined to comparisons and researches; they adjusted with great accuracy two standards, namely, the yard, and the pound troy, which are still carefully preserved, and considered of the first authority. The methods taken for preparing these standards are detailed at considerable length in their report, and are well worthy of attention. On the question, whether the troy or the avoirdupois pound should be the standard, they determined on the former, for the following reasons. "Because troy weight is best known to our law; that which hath been longest in use; that which is best known to the rest of the world; that to which our learned countrymen have referred, in comparing ancient and modern weights; and the weight which hath been subdivided into the smallest parts. On the other hand, the avoirdupois weight is of doubtful authority; and though unfit to be made a standard, yet the frequent use of it renders it necessary to ascertain how many ounces, pennyweights, and grains troy, the pound avoirdupois ought to weigh."

The committee therefore obtained, with the utmost exactness, standard weights of the several parts of the pound troy, which were made by Mr. Harris, the king's assay-master, with great skill, and proved by a very curious apparatus, contrived by Mr. Bird, the celebrated optician, which was adapted to five different beams, and which ascertained the weights, from twelve ounces down to one grain

inclusive, and that with so much correctness, as to discern any error in the pound to the 230,400th of the weight, and to the 2000th part of a single grain. By this apparatus the several parts of the standard pound were examined and adjusted, in every progressive combination necessary to discover their proportions to each other; and upon all these trials the several weights appeared so exact, that, to use the words of the committee, "no greater degree of correctness could in the nature of things be expected."

A copy of this standard pound was delivered to the house of commons, and another deposited in the Mint, where it is still preserved, and also Mr. Bird's apparatus. With these some very accurate trials have been lately made by Mr. Bingley, the present assay-master. "One of those trials deserves particular notice, as tending to confirm the proportion between troy and avoirdupois weight, which has been differently stated in works of high authority, varying from 6998 to 7010 grains troy to the pound avoirdupois. It was, however, found by the trial above-mentioned, that the avoirdupois standard pound kept in the Mint weighs exactly 7000 grains troy; and it was further ascertained, that this pound of the Mint perfectly agrees with the bell standard pound at Guildhall, and also with that, of 1588, kept at the Exchequer; and the agreement was the more curious, as the Mint standard pound had always been kept carefully packed up in paper, while the other two were constantly in use, and exposed to the atmosphere." Universal Cambist, vol. i. p. xv.

The standard yard of 1758 is still carefully preserved, and was compared with several others by professor Picquet, in the year 1802. These trials were made in the temperature of 62°, by means of the microscopic beam-compass, constructed by Mr. Troughton, capable of ascertaining differences to the 10,000th part of an inch; and the following were the results, as compared with the standard yard made by the same ingenious artist, and agreed upon by the Royal Society as the most accurate in its divisions and the best medium of comparison.

	Inches.
Taking Mr. Troughton's standard at -	36.00000
The parliamentary standard of 1758, made by } Mr. Bird, was found to be - - -	36.00023
Royal Society's standard, made by Mr. Bird	35.99955
Royal Society's standard, made by Mr. Graham	36.00130
Exchequer standard - - -	35.99330
Tower standard - - -	36.00400
General Roy's standard for the Trigonom. Survey	36.00036

From the foregoing view it appears, that the present standards of weights and linear measures are in a respectable state of correctness; but it is to be observed, that measures of capacity are not so accurate, especially in their subdivisions; and the variations are greatly increased by local customs, particularly in corn measures; an evil which the power of parliament has been hitherto unable to correct, notwithstanding the severe penalties which have been enacted at different periods to enforce uniformity. The committee of 1758 seemed to despair of success in this respect, by the remark in their report, p. 460, "that the repeated endeavours of the legislature, ever since Magna Charta, to compel one weight and one measure throughout the realm, never having proved effectual, there seems little to be expected from reviving means which experience has shewn to be inadequate, and yet it was difficult to devise any thing entirely unattempted by former parliaments."

Since the above period, several publications have appeared on the subject of standards, among which the communications

munications of fir George Shuckburgh Evelyn, in the Philosophical Transactions, deserve particular notice, as very scientific and accurate. Plans too have been proposed in parliament, and though not adopted, are well worthy of being recorded, as such may prove useful on future occasions.

In 1789, fir John Riggs Miller moved for a committee of the house of commons "to investigate and report on the best means of adopting an uniformity of weights and measures." He suggested the propriety of adopting the pendulum as the standard of linear extension; but the subject was not resumed the next session. The plan, however, was strongly recommended by a publication of the Rev. George Skene Keith, who proposed the decimal system, which was soon after established in France.

In 1814, fir George Clerk moved for a select committee of the house of commons "to enquire into the original standards of weights and measures, &c." And, in order to obtain information as to what were the best means of comparing linear measures with some invariable natural standard, the committee examined professor Playfair and Dr. W. Hyde Wollaston. Their report on the occasion contains much useful and important information; and a bill founded on it was brought into parliament. The plan was well received, and in the beginning of the present year, (1816,) the bill passed the house of commons without opposition, but was lost on the second reading in the house of lords.

The chief object of this bill was to abolish all the present measures of capacity, except coal measure, and to adopt one only in their stead. The proposed standard gallon was to be ascertained by weight; that is, when filled with pure water at a temperature of 62°, it was to weigh 10 lb. avoirdupois, and this standard was deduced from the weight of a cubic foot of pure water, which had been found to weigh, at the same temperature, 1000 ounces avoirdupois. Hence the proposed gallon was to measure 276.48 cubic inches. It was likewise proposed to make the avoirdupois, instead of troy weight, the standard for regulating weights; and to adjust the long measures by the length of the pendulum. (Other particulars of this bill, as well as the report of the committee, may be seen in the Appendix to Kelly's Metrology.)

The committee, not seeming satisfied with the experiments hitherto made on the pendulum, referred the consideration of the subject to the Royal Society, who have ordered a new measurement of it to be made. This operation is now in progress, under the direction of a committee, who have selected three members for the performance: namely, Dr. Young, Dr. Wollaston, and Mr. Troughton. Since these experiments have commenced, the earl Stanhope has moved in the house of lords, that an address should be presented to the Prince Regent to appoint a committee of scientific men, to be selected from the universities and mathematical institutions, to determine on the best standards for an improved system of weights and measures.

From such a co-operation much may be expected, and we hope to have an opportunity of stating important results in our article WEIGHT. At present, we shall proceed to shew what has been hitherto effected in seeking invariable standards from nature, and as the purpose of those researches is of a popular nature, we shall endeavour to be as elementary and minute as the subject will admit.

Invariable Standards from Nature.—If arbitrary standards could be preserved uniform, they would answer all the useful purposes for which they are intended; but as all material substances are liable to decay, methods have been proposed for obtaining standards from some unalterable

property of nature, by which lost measures might be restored, or new systems established: but it is remarkable that, in deducing standards from nature, nature opposes many obstacles difficult to be surmounted. Among the different methods that have been suggested, two only have been pursued with any degree of success, namely, the length of a pendulum that vibrates seconds of mean time; and the length of an arc or portion of the meridian. If the earth had been a perfect sphere, those measures might be obtained without much difficulty; but it is a kind of oblate spheroid, having its equatorial diameter longer than its axis or polar diameter. Hence the gravity of bodies varies on its surface, in proportion to their distance from the centre of the earth; and, therefore, a pendulum must be longer at the poles than on the equator, in order to vibrate equal portions of time. From the spheroidal figure of the earth, too, the degrees of the meridian vary, increasing in length, like the pendulum, from the equator to the pole. In order to ascertain these variations, many calculations and measurements have been made by the greatest mathematicians; and yet, with all their accumulated labours, up to the present time, the solutions are unsatisfactory. "It appears," says Laplace, in his *Système du Monde*, "that the earth differs sensibly from an ellipsoid: there is also reason to believe that its two hemispheres are not equal on each side of the equator." Doubts are likewise entertained of the uniformity of gravitation in different longitudes, though in the same latitude; and also of the equality of degrees of the meridian in those situations. The ratio, therefore, of any portion of the meridian to the whole circle is uncertain.

According to fir Isaac Newton's theory, the equatorial diameter is to the polar as 230 to 229; or, in other words, the earth's ellipticity is $\frac{1}{33}$. This computation was made on the hypothesis, that the earth is an homogeneous ellipsoid; but on the supposition that it is heterogeneous, the ellipticity or oblateness is found to be less, as may be seen by the tables contained in this article.

The measurement of a degree of the meridian was attempted at a very remote period by the Egyptians, as already noticed; but from the rude and imperfect state of the mechanical arts in ancient times, great doubts must be entertained of the accuracy of such operations. With respect to the pendulum, it was not known to the ancients; but it has greatly engaged the attention of modern astronomers and mechanists, as well as the measurement of the meridian. For a particular account of both, see our articles DEGREE, EARTH, and PENDULUM.

Huygens was the first who proposed the pendulum as the standard for linear measure; that is, its length from the point of suspension to the centre of oscillation. The third part of this distance he termed the horary foot, which he recommended to be the universal standard: but the variations of its length in different latitudes, as well as the great difficulty of obtaining the exact measurement, above stated, seemed to condemn this plan as wholly impracticable. The same ingenious philosopher proposed the method of obtaining the length of the pendulum by means of a rectangular cone; which when suspended by its vertex, and made to vibrate, the centre of its base he demonstrated to be the centre of oscillation, and reciprocally, if suspended by the centre of its base, its vertex would be the centre of oscillation, supposing, in both cases, that the length of the isochronous simple pendulum was equal to the altitude of the cone, or the semidiameter of the base. He likewise suggested, as an invariable standard of length, the space that a heavy body would fall through in a second of time; but
this,

this, like the pendulum, must vary in different latitudes, and is, moreover, affected by the resistance of the atmosphere. The operation is, in many other respects, very difficult to be performed with any degree of accuracy.

About the year 1778, the public attention was particularly excited and directed to the subject of standards from nature, by the Society for the Encouragement of Arts, Manufactures, and Commerce, in London, who advertised a premium of 100 guineas, or a gold medal, as a reward to any person who would propose an improved means "for obtaining invariable standards for weights and measures, communicable at all times, and to all nations." Among the candidates for this reward was Mr. Hatton, who proposed the application of a moveable point of suspension to one and the same pendulum, by which he intended to accomplish the full effect of two pendulums; and the difference of their lengths was to be the required measure. Mr. Whitehurst improved upon his plan by means of two pendulums, the vibrations of which were in a ratio of two to one. By this method it was generally admitted, that the difference between the rods of two pendulums, whose vibrations are known, is a datum from which may be derived an invariable standard measure, as well as many other useful problems relative to gravitation, to falling bodies, and to the figure of the earth. By these experiments it was ascertained, that the length of a seconds' pendulum in the latitude of London, vibrating in a circular arc of $3^{\circ} 8'$, is very nearly 39.119 inches, but performing the same motion in the arc of a cycloid, the result would be 39.136.

Experiments, which were supposed to be still more accurate, were afterwards made by Mr. Graham; and a plan was proposed to parliament, as before noticed, for adopting the pendulum as the standard of length; but it was more warmly taken up in other countries. M. Talleyrand, then bishop of Autun, and Mr. Jefferson, the secretary of state in America, turned their thoughts very earnestly to the subject. Mr. Jefferson proposed, in the house of representatives, that the length of a pendulum in lat. 38° , which he reckoned the medium of the United States, should be adopted as a standard on which to found a new system of weights and measures, and his plans were approved, but never carried into effect.

It was first proposed in France, that the length of the pendulum should be made the standard, taken in the latitude of Paris ($48^{\circ} 50'$); but the latitude 45° was afterwards preferred, as most likely to be universally received, being the medium between the equator and the poles. A report to this effect was made to the National Assembly, in which it was agreed, that the measurement should be entrusted to a committee of six members of the Academy of Sciences in Paris, and to six members of the Royal Society of London. But this plan was afterwards rejected by the academicians Lagrange, Laplace, Lalande, Borda, Monge, and Condorcet, who recommended a standard from the measurement of an arc of the meridian. As this seems the most scientific operation, and important change that has ever been made in any system of weights and measures, we shall give a full account of it here, extracted from their constitutional code.

Extract from the constitutional laws of the new system of measures in France.

"By a decree of the 8th of May, 1790, sanctioned the 22d of August, the constituent assembly desiring that all France should enjoy for ever the advantage that must result from an uniformity of weights and measures, commissioned the Academy of Sciences to determine the length of the pen-

dulum, and thence to deduce an invariable standard for all weights and measures.

"The length of the pendulum, at first, appeared proper for the basis of the system of measures, being easy to determine, and consequently to verify, if it should be necessary by any accidents happening to the standards; but it was observed, that to take, as was proposed, for the unit of measures, the length of the simple pendulum vibrating seconds, was to employ, in order to determine a measure of length, not only an heterogeneous element,—time, but also an arbitrary division,—the 86,400th part of the day. A measure of length was therefore preferred that did not depend on any other quantity; and it will be seen afterwards (*Précis des Experiences, &c.*) that observations of the pendulum can nevertheless be employed as a means of verifying, and even of finding that unit of measure, although they have not served as the basis of its determination. An unit of measure, taken on the earth even, has the advantage of being perfectly analogous to most of the measures that are likewise taken on the earth, as the distances between points of its surface, or the extent of portions of this same surface: it is, in fact, more natural to compare the distance of one place to another to the quadrant of one of the terrestrial circles, than to the length of the pendulum. In short, it was observed, that as the 10,000,000th part of the quarter of the meridian, or the metre, differed only from the pendulum vibrating seconds at Paris about six millimetres, both units would have led to results almost exactly similar."

A second decree of the same day commissions the Academy to appoint the most convenient scale of division for weights and measures, and also for monies.

The decree of the 26th of March, 1791, sanctioned on the 30th, to fix an unit of measure, natural and invariable, and which, in its determination, contains nothing arbitrary or peculiar to the situation of any people on earth, adopted, according to the advice of the Academy of the 19th of the same month, the dimensions of the quadrant of the terrestrial meridian as the basis of the new system of measures.

"The quadrant of the meridian should be preferred to the quadrant of the equator, on account of the great difficulties that the necessary operations to determine this last element would have presented, and their verification, if it were ever wished to have recourse to it. The regularity of this circle is not better ascertained, than the similitude or regularity of meridians. The size of the celestial arc answering to the portion of the equator that would have been measured, is less susceptible of being determined with precision: in short, every nation belongs to one of the meridians of the earth; one part only is placed under the equator."

The new system of weights and measures, founded on the measure of the meridian of the earth, and on the decimal division, was adopted by the law of the 1st of August 1793, under a nomenclature and on a basis, both of which have since experienced changes.

"This nomenclature, modified by the law of the 30th Nivose an. 2, did not admit the decimal multiples *deca*, *hecto*, *kilo*, and *myria*, but only the sub-multiples *deci* and *centi*. In order to make up for this, several denominations in each class of measures had been adopted. Thus, the *miliare* expressed 1000 metres; the *grade*, 100,000; the *cadil* corresponded with the litre, the *cade* to the kilolitre, the *gravet* to the gramme, the *grave* to the kilogramme, the *bar* to 1000 kilogrammes; and the words *decadil*, *centricadil*, *decicade*, *centicade*, *decigravet*, *centigravet*, *decibar*, and *centibar*, expressed the tenth and hundredth parts of these different units. The name *are* was given to the measure at present called *hectare*: the *franc* should be of the weight of 10 gravets, that is to say, double

double what it now is." According to this simple sketch, it will be readily confessed that the nomenclature adopted by the law of 1795, is more methodical, more conformable to the principles of common numeration, and therefore more susceptible of all applications of the decimal calculation.

Some laws applied also the decimal scale to the division of the day and of the year, which did not require such a change; they have been successively repealed.

Extract from the law of the 18th Germinal, 1795, relative to weights and measures.

Art. II. There shall be but one standard of weights and measures,—it shall be a rod of platina, on which the metre, the fundamental unit of the whole system of measures, shall be traced.

The second article of the law of the 19th Frimaire, 1800, acknowledges also the kilogramme for the standard.

Art. V. Their nomenclature is definitively adopted as follows:

Metre, the measure of length, equal to the 10,000,000th part of the arc of the terrestrial meridian, contained between the north pole and the equator.

Are, the measure of superficies for land, equal to a square of ten metres each side.

Stère, the measure particularly intended for fire-wood, and which shall be equal to the cubic metre.

Litre, the measure of capacity, both for liquids and dry goods, the contents of which shall be equal to the cubic metre.

Gramme, the absolute weight of a volume of pure water, equal to the cube of the hundredth part of the metre, of the temperature of melted ice.

The unit of monies shall be called *franc*, to replace the name *livre*, used hitherto.

Art. VI. The tenth part of the metre shall be called *decimetre*, and its 100th part *centimetre*; what shall be called *decametre* is a measure equal to 10 metres, which supplies a convenient measure for surveying. *Hectometre* shall signify the length of 100 metres. *Kilometre* and *myriametre* shall be lengths of 1000 and 10,000 metres, and shall designate principally itinerary distances.

Art. VII. The denominations of the measures of other kinds shall be determined according to the same principles as those of the preceding article.

Thus, *decalitre* shall be a measure of capacity ten times smaller than the *litre*; *centigramme* shall be the 100th part of the weight of a gramme.

Decalitre shall likewise be used to designate a measure containing 10 litres; *hectolitre* for a measure equal to 100 litres; a *kilogramme* shall be a weight of 1000 grammes.

In a similar manner the names of all other measures shall be composed.

For a comparison of the French and English weights and measures, see our articles MEASURE and WEIGHT.

Present State of Standards of Weights and Measures in France.—The success of the metrical system adopted in France is a subject of interelling and important inquiry. The plan was originally considered so excellent, that hopes were entertained of other nations following the example. This expectation, however, has not been realized, nor has that beautiful and scientific theory been found unexceptionable in practice. On the contrary, it met with such opposition on account of the Greek and Latin terms, and the decimal divisions, that in 1801 the government allowed the people to use, for a limited time, their ancient vocabulary of names, applying them to the new standards, which are still retained. And in 1812, a further concession was made, by the imperial government, to the pre-

judices and habits of the people. They were allowed to continue the ancient vocabulary applied to the new standards, with the word *usuel* added to each: thus, two metres are the *toise usuelle*; half a kilogramme, the *livre usuelle*, &c.: and these units are not divided decimally, but into halves, quarters, and eighths: the long measures are also divided duodecimally.

Besides the binary divisions of weights, the *livre usuelle* is divided into ounces, gros, and grains, like the ancient *livre*, *poids de marc*. Hence, the new ounce and its divisions depart so widely from the gramme, that the proportion cannot be ascertained without a troublesome calculation.

Thus, after more than twenty years of troublesome experiment and trial of the metrical system, the only advantage that has been gained is that of establishing one common standard, the *metre*; but uniformity might as well have been obtained by making their ancient *toise*, (so universally known,) their standard. The chief recommendation of the metre, as stated in the foregoing decree, as well as by the authors on the metrical system, Brillat, Brisson, and Tarbé, is, that should it be ever altered or lost, it may be easily restored, not by a second measurement of the meridian, but by a comparison with the pendulum. Thus they allow the pendulum to be the regulator of linear measure as well as of time, and, in short, the ultimate criterion, and of course the principal standard.

The following tables shew at one view the labours of the greatest mathematicians and philosophers to determine the figure of the earth, and thence to deduce standard measures. But it may be proper first to premise, in addition to our account of experiments on the pendulum by the English and French astronomers, what those of Spain have recently done in different parts of the globe, in pursuit of the same important object.

About the year 1789, the Spanish government sent out an expedition of two frigates, the *Descubierta* and the *Atrevida*, under the command of Alexander Malaspina, in order to make experiments with the pendulum in different parts of the world, and particularly with a view to ascertain if the southern hemisphere differed from the northern, as was supposed, and indeed warranted, by the few measurements antecedently made on the south side of the equator by La Caille and Bouguer.

The new experiments were made with a deal rod pendulum, and other necessary apparatus, under the direction and management of M. Ciscar, who appears to have been well qualified for the undertaking. The particulars of his important labours are detailed by M. Mathieu, in the "Connoissance des Temps" of the present year (1816), who states that M. Ciscar made sixteen experiments, from N. lat. $59^{\circ} 2'$ to S. lat. $51^{\circ} 2'$, and in very different longitudes; and compared them with the theory which Laplace established in his "Mecanique Celeste," on fifteen measurements of the pendulum, which led, by one method of calculation to make the earth's ellipticity $\frac{1}{237}$, and by another $\frac{1}{337}$. The results deduced from M. Ciscar's experiments do not determine which is correct, but they tend to shew that the two hemispheres are nearly alike, as may be seen by the following table of ellipticities.

As to the lengths of the pendulum, they do not differ materially from those already computed, making allowance for its being lengthened, in order to make the same number of vibrations in a vacuum as it did in the air. The calculations given of these alterations, according to the variable state of the atmosphere, are very curious, and well worthy the attention of philosophers engaged in experiments on the pendulum.

STANDARD.

Length of a Degree of the Meridian in different Latitudes.

Countries.	Mean Latitude.	Length of Degree.	Measurers.	Dates.
	° ' "	Eng. Miles.		
Peru - - -	0 0	68.751	Juan - - -	1744
Peru - - -	0 0	68.732	Bouguer - - -	1744
Peru - - -	0 0	68.713	Condamine - - -	1744
India - - -	12 32 N.	68.743	Lambton - - -	1803
Cape of Good Hope -	33 18 S.	69.076	La Caille - - -	1752
America - - -	39 12 N.	68.897	Mafon and Dixon -	1768
Italy - - -	43 00	68.998	Boscovich - - -	1755
Italy - - -	44 44	69.061	Beccaria - - -	1764
France - - -	44 52	68.769	Biot and Arago -	1808
France - - -	45 00	69.092	La Caille - - -	1740
France - - -	46 12	69.052	Delambre and Maupertuis	1793
Germany - - -	47 40	69.142	Leifganig - - -	1766
France - - -	49 20	68.763	Fernel - - -	1525
France - - -	49 22	68.945	Picard - - -	1669
France - - -	49 22	69.119	Caffini - - -	1718
France - - -	49 22	69.121	Caffini - - -	1740
France - - -	49 23	69.114	Academicians - -	1744
England - - -	51 30	69.146	Mudge - - -	1802
England - - -	52 2	69.133	Mudge - - -	1802
Holland - - -	52 4	66.91	Snell - - -	1620
Lapland - - -	66 20	69.403	Maupertuis - - -	1737
Lapland - - -	66 20	69.292	Swanberg - - -	1803

Length of a Pendulum vibrating Seconds in different Latitudes.

Names of Places.	Mean Latitude.	Length of Pendulum.	Names of Observers.
	° ' "	Eng. Inches.	
Equator - - -	0 0	38.989	Bouguer.
Porto Bello - - -	9 34 N.	38.997	Bouguer.
Pondicherry - - -	11 55	39.005	Le Gentil.
Madras - - -	13 04	39.026	Sir J. Warren.
Jamaica - - -	18 00	39.019	Campbell.
St. Domingo - - -	18 27	39.017	Bouguer.
Cape of Good Hope	33 25 S.	39.083	Bouguer.
Cape of Good Hope	33 25 S.	39.070	La Caille.
Toulouse - - -	43 36 N.	39.099	Darquier.
Geneva - - -	46 12	39.092	Mallet.
Vienna - - -	48 12	39.113	Leifganig.
Paris - - -	48 50	39.119	Bouguer.
Paris - - -	48 50	39.123	Mairan.
Paris - - -	48 50	39.134	Borda.
Gotha - - -	50 57	39.121	Zach.
London - - -	51 32	39.121	Emerson.
London - - -	51 32	39.128	Defaguliers.
London - - -	51 32	39.119	Whitehurst.
London - - -	51 32	39.136	Dr. Rotheram, in a cycloid.
London - - -	51 32	39.126	Graham.
London - - -	51 32	39.200	Sir Jonas Moore.
Leyden - - -	52 09	39.140	Luloffs.
Arensburg - - -	58 14	39.147	Greschow.
Petersburgh - - -	59 56	39.163	Mallet.
Pillau - - -	66 48	39.181	Maupertuis.
Lapland - - -	66 48	39.172	Academicians.
Lapland - - -	67 04	39.181	Mallet.

TABLE of the Ellipticities of the Earth, found by different Modes of Measurement and Calculation.

Authors.	Ellipticities.	Principles.
Huygens Newton	$\frac{1}{2579}$ $\frac{1}{2526}$	Theory of gravity.
Mauertuis, &c.	$\frac{1}{314}$ $\frac{1}{125}$ $\frac{1}{213}$		Mensuration of arcs.
Swanberg	$\frac{1}{323}$	Rotatory motion. Vibration of pendulum.
Clairaut	$\frac{1}{111.3}$ $\frac{1}{337}$		Occultation of stars. Precession and nutation.
Treifnecker	$\frac{1}{325}$ $\frac{1}{305}$	Theory of the moon Pendulum from fifteen experiments.
Laplace	$\frac{1}{336}$ $\frac{1}{321}$		From the same, by a different calculation.
Delambre	$\frac{1}{305.6}$	Comparison of meridians measured in different places. Pendulum in N. lat.
Cifcar	$\frac{1}{323}$ $\frac{1}{317.6}$ $\frac{1}{317}$		Pendulum in S. lat.

We have pursued this article to considerable length, as well on account of its general importance, as its peculiar interest at the present time, when plans are set on foot for establishing new standards, and improving the British system of weights and measures.

From the foregoing view of the subject it appears, that, however profound and accurate the labours of the learned have been in search of invariable standards from nature, weights and measures have hitherto derived but little practical advantage from their researches, except indeed what has been effected in France; and the utility of the alterations there is questionable, when balanced against the great inconvenience that has been experienced, and which is likely long to continue.

The chief use of standards from nature is to restore established measures, should they be ever lost; a supposition highly improbable, and of which there are few examples. In short, standards from nature can be only known by comparison with a scale of established arbitrary measures. The researches of the learned, however, should be encouraged, as they may likewise lead to other useful and important discoveries in arts and sciences.

The plan of assimilating the standards of different nations has been at all times a favourite subject with philosophers and statesmen. Such was the benevolent but Utopian wish of Budeus, an eminent author of the twelfth century, who thus expresses himself in his work, entitled "De Re Nummaria."

"Una fides, pondus, mensura, moneta sit una,
Et status illævus totius orbis erit."

"One faith, one weight, one measure, and one coin,
Would soon the jarring world in friendship join."

"Experience, indeed, shews (says a late writer on Metrology), that plans for assimilating the standards of different countries, are as impracticable and visionary as proposals for establishing an universal language. History likewise shews, that while governments change with great facility their money systems, their constitution, and even their religion,

weights and measures seem immovable. They are indeed so mixed, and, as it were, matted with every concern of property, that they cannot be essentially altered without violence and confusion; nor are those evils of a temporary nature. The habits, customs, and prejudices of the multitude are not to be speedily changed. It was computed in France, that in three generations their metrical system would be fully established; but now it seems to require more. In England, the constant vigilance of the legislature for 500 years has been employed in correcting abuses rather than in improving the system. In short it appears, that nothing has a greater tendency to grow worse, or more obstinately resist improvement, than weights and measures."

Standard of Bullion and Coins.—The standard for bullion is a certain proportion fixed by law between the weight of pure gold or silver in any quantity, and the weight of alloy, which proportion is called the *fineness*. Thus, the standard fineness of gold coins in England is 27 carats, or $\frac{27}{24} = \frac{9}{8}$; and the standard fineness of silver coins is 11 oz. 2 dwt., or $\frac{5}{16}$. See our articles ASSAY, BULLION, and COIN.

Wrought gold, however, has two legal standards; the one 22 carats, as above, and the other 18 carats; the latter began in 1798, and is chiefly used for watch-cases and rings.

Wrought silver has likewise two legal standards; the one 11 oz. 2 dwt., as above, and the other 8 dwt. better; that is, 11 oz. 10 dwt. The latter, which is called new sterling, is of ancient standing, but seldom used.

Standard of Coins.—Besides the legal fineness for coins, there is also a standard weight fixed by law. Thus in England, a pound troy of standard gold is coined into 44½ guineas, and of standard silver into 62s. A law, however, has been recently enacted (June 1816), by which the standard weight of silver is altered, but the fineness both of this metal and of gold remains unchanged.

The new standard Weight of English silver coin is, that one pound troy of standard fineness shall be coined into 66s. Thus the weight of the new shilling is to be 3 dwt. 13 $\frac{3}{4}$ gr. and the other new silver coins in proportion.

No alteration is to take place in the gold coins; but gold pounds are to be coined in proportion to the guinea. Each will therefore be $\frac{20}{17}$ of a guinea, and must weigh 5 dwt. 3 $\frac{2}{3}$ gr. of standard gold, and 115 gr. of pure gold, without any allowance for remedy. But according to the regulation which allows a guinea of 5 dwt. 8 gr. to be a legal tender, the gold pound weighing 5 dwt. 13 $\frac{3}{4}$ gr. will be also legal.

By the new law of 1816, gold is declared to be the standard of value, or the measure of property, by which the par of exchange, and the value of silver and all other commodities, should be estimated.

It has been long a question of doubt, whether gold or silver should be the standard of value. Locke and other authorities state it to be silver; but lord Liverpool, in his "Letter to the King on the Coins of the Realm," observes, that "coins, which are the principal measures of property, should be composed of one metal only, and that this should be gold."

By a law of 1799, the question was settled with respect to large payments, as it was then declared that silver should not be a legal tender for any sum above 25*l.*; but by the law of 1816, gold is the only legal tender that can be made for any sum exceeding 42 shillings.

Standardizing Bullion and Coins.—The precious metals in England, whether in bullion or foreign coins, are generally bought and sold at so much *per ounce* standard, which is calculated from the assay-master's report of weight and fineness.

STANDARD.

The following are the characters generally used in those reports.

j	is	1 dwt. or oz.
ij	—	2 ditto.
2	—	5 ditto.
e	—	10 ditto.
e2	—	15 ditto.
e2ij	—	18 ditto.
eje	—	19 ditto.
ob	(obolus)	$\frac{1}{2}$ ditto.

Rules for standarding Bullion and Coins.—The common method of finding the value of small quantities of gold and silver is by allowing, from the assay-master's report, at the rate of 4s. per carat, B. or W., in every ounce weight of gold; and at the rate of 6d. per ounce, B. or W., in every ounce weight of silver. But when silver is more than 10 dwt. worse, an allowance of 2d. per ounce must be made for refining.

The following are the scales of allowance.

Scale for Gold.	Scale for Silver.
1 car. (4s.)	1 oz. (6d.)
1 gr. (1s.)	15 dwt. ($4\frac{1}{2}d.$)
$\frac{1}{2}$ gr. (6d.)	10 dwt. (3d.)
$\frac{1}{4}$ gr. (3d.)	5 dwt. ($1\frac{1}{2}d.$)
	$2\frac{1}{2}$ dwt. ($\frac{3}{4}d.$)

Thus, to find the value of 2 oz. of gold B. 1 car. 1 gr. at 4l. per oz. To 8l. (for 2 oz.) add 10s. for better, which gives the value 8l. 10s. And to find the value of 12 oz. of silver, W. 10 dwt. at 5s. 6d. per oz. From 3l. 6s. (for 12 oz.) subtract 3s. for worse, which gives the value 3l. 3s.

Rules for standarding Gold.—As 22 carats are to the assay or report of fineness, so is the grofs weight to the quantity that is to be added or subtracted from this grofs weight, according as the report is better or worse. If better, the additional quantity is called (by the trade) *betternefs*, and if worse, the subtracted quantity is called *worsenefs*.

Example.—How much standard gold is there in an ingot of the following report, B. 1 car. $3\frac{1}{2}$ gr. weight, 67 oz. 15 dwt. 8 gr.?

As 22	:	1 $3\frac{1}{2}$	::	oz. dwt. gr.	67 15 8
4	4	—		20	
88	7	—		1355	
4	4	—		24	
352	30	—		32528	gr.
				30	oz. dwt. gr.
				÷ 352	= 2772
				= 5 15 12	
				oz. dwt. gr.	
To	67	15	8	grofs weight	
Add	5	15	12	betternefs.	
	73	10	20	standard.	

The following method for standarding gold may be generally used with advantage.

	oz. dwt. gr.				
	67 15 8				grofs weight, B. or W. 1 car. $3\frac{1}{2}$ gr.
2 gr =	$\frac{1}{2}$	33 17 16			
1	=	$\frac{1}{2}$	16 18 20		
$\frac{1}{2}$	=	$\frac{1}{2}$	8 9 10		
		2) 127 1 6			
		—			
		11) 63 10 15			} divided by 22.
		—			
		5 15 12			betternefs or worsenefs, as above.

Rules for standarding Silver.—As 11 oz. 2 dwt. are to the assay, so is the grofs weight to the quantity that is to be added or subtracted.

Example.—In 287 oz. of silver, W. $12\frac{1}{2}$ dwt., how much standard?

As 11	2 :	12 $\frac{1}{2}$	::	287	
20		—		20	
222		—		2840	
				12 $\frac{1}{2}$	
				dwt. gr.	oz. dwt. gr.
				222) 71750	(323 4 = 16 3 4
				oz. dwt. gr.	
				From 287 0 0	grofs weight
				Subtract 16 3 4	worsenefs.
				270 16 20	standard.

From the last example, the reason of the following rule for standarding silver is obvious, viz.

Multiply half the weight in ounces by the assay in pennyweights, and divide the product by 111, the quotient will be the betternefs or worsenefs in ounces.

Example.—How much standard silver in 160 ounces of B. $18\frac{1}{2}$ dwt.?

Half weight	80				
	18 $\frac{1}{2}$				
	111) 1480			(13 oz. 6 dwt. 16 gr.	
	370			To 160 0 0	grofs
	333			Add 13 6 16	betternefs.
	37			173 6 16	standard.
	20 &c.				

It should be observed, that there are tables constructed, and sometimes used, for standarding gold and silver, as may be seen in Pottlethwayt's Dictionary of Commerce, vol. i. p. 388—398. But from the simplicity and conciseness of the foregoing examples, it is manifest that such tables cannot much shorten the operation, though they may serve to check or prove the calculation. Universal Cambist, vol. ii. p. 193.

STANDARD, in *Botany and Vegetable Physiology*, *Vexillum*, is the solitary superior petal of papilionaceous flowers, generally of a larger size, and more conspicuous colour, than the other petals. See **PAPILIONACEOUS**.

STANDARD, in *War*, a sort of banner or flags borne as a signal

signal for joining together of the several troops belonging to the same body. See FLAG, &c.

The standards were originally large flags, fixed on the tops of towers or other elevated places; and from their being stationary, were called standards; though this term was afterwards given to moveable ensigns, as at present to those borne by the cavalry.

Du-Cange derives the word from *standarum* or *stantarum*, *standardum* or *standale*, words used, in the corrupt Latin, to signify the principal flag of an army. Menage derives it from the German, *stander*, or the English, *stand*.

The standard is usually a piece of silk, a foot and a half square, on which are embroidered the arms, device, or cypher of the prince, or of the colonel. It is fixed on a lance, eight or nine feet long, and is carried in the centre of the first rank of a squadron of horse by the cornet.

The standard is used for any martial ensign of horse; but more particularly for that of the general; or the royal standard. Those borne by the foot are rather called colours.

The ancient kings of France bore St. Martin's hood for their standard. The Turks preserve a green standard, borne by Mahomet, with a great deal of devotion, as believing it to have been brought down by the angel Gabriel. Every time it is displayed, all who profess the Mahometan faith are obliged to take arms; those who refuse are to be deemed as infidels.

STANDARD-Guard. See GUARD.

STANDARDS, for the Roman, see SIGNA.

STANDARD, *Royal*, in *Sea Language*, is a flag in which the imperial ensigns of Great Britain, and the arms of France and Ireland, together with the armorial bearings of Hanover, are united and quartered. This is never hoisted unless when the sovereign is aboard, and then it is displayed at the main-top-mast-head.

STANDARDS, in *Ship-Building*, large knees of oak or iron, fayed on the deck and against the side. The arm upon the deck stands upon a sole, and is bolted through the beams, and clenched underneath; and the other arm through the ship's side. There is also a standard fayed on the gun-deck, against the apron forward, and another against the transoms abaft; also one against each riding-bitt, and one in head upon the knee, when the piece against the stem does not run high enough for the hole of the main-stay collar. Standards are also large poles, set up endways, about ten feet asunder, round the edges of slips, to which the spars are hung to support the staging. They have cleats nailed up their foremast and after sides, at about two feet distance.

STANDARD *Trees*, in *Planting*, are all such as stand singly, with an upright stem, without being trained to any wall or other support. In *Gardening*, they are mostly distinguished into three sorts; as *full standards*, *half standards*, and *dwarf standards*, from their being occasionally trained in all these ways; but forest and tall ornamental trees rarely in any other than full standards; though in the shrub tribe they are occasionally formed into both half and dwarf standards, according to their natural growths.

Full standards are such trees as are trained with tall, straight, clean stems, six or seven feet high, or more, then suffered to branch out at that height all around, to form a head, as in common standard apple and pear-trees, some forest-trees, &c. These should be trained accordingly in their minor growth, by trimming off all the lower lateral branches gradually, as the stem advances in height; suffering the leader always to remain entire, especially in all forest-trees;

or, if it should happen to fork, taking off the worst, and leaving the straightest shoot to run up, to continue the prolongation of the stem to the height above-mentioned. In fruit-trees, the stem is often cut or topped at the height of six or seven feet, to force out a set of laterals in that part, so as to form a regular spreading head of a moderate height, for the greater convenience of gathering the fruit; but for all kinds of forest-tree standards, the tops should never be reduced, but the leaders be permitted to remain entire to run up in height; as the beauty and worth of such trees consist in their lofty growth.

Most sorts of fruit-trees may be trained for full standards, except vines; though some of them will not ripen their fruit effectually in this way, as peaches, nectarines, and figs: but, on the other hand, all sorts of apples, pears, plums, and cherries, ripen their fruit freely on standards of this kind.

And all sorts of fruit-trees for this purpose are mostly raised by grafting, &c. on the freest strong-shooting stocks, and trained with straight clean stems full five or six feet high, as above, either the stock trained up to that height, and then grafted or budded, the graft or bud branching out forming the head; or the stock grafted near the ground, and the first shoot from the graft or bud trained up for a stem to the proper height, then suffered to send forth branches: in either method, it is next to be considered whether it be intended the tree shall form a spreading open head, or assume a more erect and aspiring growth: in the former case, if the leading shoot of the graft or bud be topped at six or seven feet from the ground, it will force out lateral shoots at that height, and commence a spreading head, open in the middle, suffering, however, the whole afterwards to take their own growth; and in the latter, by permitting the leading shoot to remain entire, it will aspire in height, and the whole head will assume a more upright and lofty growth: in both methods the heads will afterwards naturally branch out abundantly, and furnish themselves sufficiently with bearing wood, producing fruit, in some sorts, in two or three years from the grafting and budding, as in cherries, apples, &c. but pears are sometimes four, five, or six years before they bear. See GRAFTING.

It is expedient to train most of the principal hardy fruit-trees as full standards, that, when planted in continued rows, either in gardens or orchards, by having tall stems, they may admit the influence of the sun and air more freely to the heads, and permit the obtaining crops of excellent plants, grass, &c. from the ground under them, over which their spreading branches extend.

In respect to the management of full standard fruit-trees, little is required, after the first training, to form the stem to the proper height, and the first shoots are advanced at top, to give the head its first formation; being allowed to advance nearly in their natural order, except reducing any very irregular growths, permitting the whole to shoot in length, and branch laterally in their own way; by which they naturally form fruit-spurs along their sides upwards for bearing. The irregular branches must, however, be removed, and the heads kept properly thinned, as well as the suckers rubbed off from the stems or other parts, and the dead wood be wholly taken away. See PRUNING.

Standard fruit-trees with high stems are sometimes planted against walls, and trained as wall-trees: this is practised for high walls, so as immediately to cover the upper parts of them, whilst dwarfs and half standards cover the bottom and middle parts, and thus every part of the wall is fully occupied at once: but in these cases the dwarf-trees

are to remain, the others being wholly destroyed after a time. See *WALL-Trees*.

These sorts of high standards are likewise occasionally placed against the ends of buildings; some choice sorts of pears in particular: also apricots in a southerly aspect, and other fruit-trees of the same kind.

Half standards are trained with stems only three or four feet high, and then suffered to branch out to form heads. It is a method of training practised for many sorts of fruit-trees, both as detached standards for variety, and the convenience of gathering the fruit, and with fanned spreading heads, as wall-trees for high walls, in order to cover certain parts of them.

The method of raising these is nearly the same as for full standards, only they are grafted or budded upon lower stocks, training them with upright single stems only three or four feet high, by the stocks on which they are grafted being trained up to that height for a stem; or by being grafted or budded low in the stock, and the first main shoot of the graft, &c. led up for a stem, and topped at that height to force out branches to form the head; suffering the heads, in those designed as detached standards, to branch out all around, and run up to a full spread, nearly according to their natural mode of growth, except just reforming any ill-growing branch, as shortening the branches should be sparingly practised, as it would force out numerous useless shoots, and prevent the formation of bearing wood, especially in the apple, pear, plum, and cherry kinds.

But when half standards are intended for walls, they should have the head trained in a somewhat fanned manner, to spread to the wall like a common wall-tree. And when it is necessary to have them to form heads of as moderate growth as possible, especially in the detached half standards for small compartments, they should be grafted or budded upon the more dwarfish sort of stocks, as apples upon codlins, and pears upon quinces, &c.; in which case the heads will always shoot moderately, and never ramble wide or grow high. See *STOCKS*.

But though a few of this sort of trees may be eligible as detached half standards for variety, they are not proper for the open quarters of the garden; as the branches coming out low may impede the growth of under-crops. A few might, however, be thinly ranged and planted along the sides or boundary parts of large wide compartments, particularly of those sorts that are wrought on dwarf-stocks, which commonly branch more moderately, and in a less spreading manner: as a good portion of the common codlin kind, which naturally shoot moderately, and are good bearers; the heads in which being, for the most part, suffered to run in their natural way of growth, except just a little occasional regulation and pruning of their branches, as suggested for full standards. For walls, however, that are eight or nine feet high, they are proper to plant between the dwarfs or principal residents, to cover the middle, or upper half of the wall, whilst the dwarfs occupy the lower space. See *WALL-Trees*.

Half-standard cherries, apricots, &c. are also proper to plant in forcing-frames, to produce early fruit. See *FORCING-Frames*.

The after-management of detached trees of this sort, in respect to pruning, is nearly the same as that of the full standards; as, after having shot out at top to form the head, they should be permitted to branch both in length and laterally nearly in their own way, except just pruning to order any considerable irregularity, crowding branches in the middle, or long rambles, and detaching all suckers from

the root, stem, and head, and cutting out casual dead wood; and thus the regular branches remaining, at length will emit fruit-spurs abundantly in every part for bearing. And the half standards against walls are to be pruned and managed as other wall-trees, each according to its nature and habits of growth.

Forest-trees, and the taller sorts of the ornamental tree kinds, are seldom or ever trained as half standards, but mostly suffered to run up in height to their full growths, unless some particular sort may be required to have the form of a bushy half standard for some special use or purpose.

Several plants of the shrub kind, in their natural growth, assume something of the appearance of half standards, though, in most instances, they are branchy to the bottom, or rise with different stems; but they might be mostly trained with a single clear stem to the height of three or four feet, and be then suffered to branch out into full heads, like half standards.

Dwarf Standards.—These are trained with low stems, only one or two feet high, and then topped, to force out branches to form the head. There are several sorts of choice fruit-trees which are trained as dwarf standards, with stems not more than one foot high, branching out at that height, forming proportionably low heads; they being occasionally planted round the borders of the kitchen or pleasure-garden, &c. instead of espaliers, and the heads either kept down low by close pruning, or suffered to branch upward nearly in their natural growth. These are raised by grafting, &c. upon the most dwarfish stocks, such as apples on codlin or paradise-stocks, and pears on quinces, &c. in order to dwarf them as much as possible in their growth; and as they shoot in height, each year's shoots either pruned short, to keep the head down, and confine it within a small compass; or the branches permitted to shoot in length, except just reducing casual rambles and disorderly growers. But by too severe pruning, too many useless shoots are forced out annually, and a sufficiency of bearing wood seldom produced, so that it rarely answers well, while by slight pruning, the trees mostly shoot more moderately, and sooner form themselves into plentiful bearers in better perfection. These kinds of dwarf standards are not so generally introduced now, since espalier fruit-trees have been brought to a proper degree of perfection in training and bearing. They might, however, be sparingly admitted, where necessary, in their different sorts, under proper moderate pruning, according to their nature.

Some have dwarf standard fruit-trees in pots, for the purpose of forcing in hot-houses, forcing-frames, hot-beds, &c. particularly early May and May-duke cherries, plums, peaches, nectarines, apricots, figs, vines, gooseberries, currants, &c. which being placed as above, in January, or early in February, often ripen a few fruit very early in tolerable perfection, some of which might be brought to table growing on the trees in the pots. Dwarf standard fruit-trees are also proper to plant out fully in the borders, in forcing-frames and houses. See *FORCING-Frames* and *DWARF-Trees*.

Also the different varieties of currants and gooseberries may be trained with a single stem a foot or more high, and then permitted to branch out into a regular head, keeping the internal part always tolerably open, and the branches moderately thin; and shortening them but sparingly, particularly the gooseberry, by which dwarf shrubby plants are formed, and which become very productive.

There are different shrubby plants of the evergreen and flowering upright one-stemmed kinds, too, which may be

trained as dwarf standards, though the greatest number of plants of the shrubby sort are the most ornamental when they rise in a bushy manner, with many stems from the bottom. These plants, when necessary, are to be trained with one stem, which is readily accomplished by retrenching and removing the superfluous parts, and trimming away all low straggling branches, so as to form a clear single stem for a small space at the bottom parts, as the nature of their growth may require, then suffering them to branch out into full heads.

Some of the low shrubs of the above sorts are supposed by some to appear to the best advantage when trained in this manner.

General Culture.—In regard to the management of standard trees of the fruit kind, when they are planted out in an irregular manner throughout the whole garden ground, which is never, or very rarely, an eligible practice, little is to be done in the way of suiting them to the nature and cultivation of the ground or soil, as they must necessarily give way in these respects to the sorts of crops which are to be raised upon the different quarters or parts of the ground. Mr. Loudon has, however, suggested, that the best way of employing standard fruit-trees and shrubs in gardens, or all which are unfastened, is either in rows, in the manner in which gooseberry plants or bushes are usually set along the sides of the beds or borders, in particular quarters of the ground by themselves; or in orchard-grounds. Standard trees of these kinds, for the borders in kitchen-gardens, should always, it is said, be kept low, in order that they may shade the crops on the different sides as little as possible. But it is thought to be perhaps the best way to have separate distinct quarters or parts for standards of these kinds; to have those of the apple and pear sorts grafted on paradise or quince-stocks, by which means they come sooner into a fruiting state; and by the time those in the orchards or on the walls are in a full bearing condition, such quarters are fit to be thrown out: and, if necessary, other quarters might be planted to succeed them. In this manner, when a new garden was wanted to be made, a tolerable supply of fruit might be had every year after the third; it being well known, it is said, that apple-trees raised on paradise-stocks, and pears on quince-stocks, will frequently bear the second year after grafting, and very generally the third: and as those to be planted in the quarters would be three or four years old before they were removed from the nursery, they would commence bearing immediately.

Standard apple-trees for orchards should generally be of the tall or high kind, and always grafted upon crab-stocks. See ORCHARD and STOCKS.

In standard small fruit-shrubs, as the different currant kinds, a great deal depends upon their being properly cut in, as they should be permitted only to produce from studs or spurs, and from these, after the shrubby bushes are four years old, the young wood being wholly cut away during winter. This method is, however, only necessary and applicable to standard currant-shrubs, where large fruit is wanted; as when currant-trees are grown against walls, and the design is to preserve fruit upon the trees from the period of the currant season until the middle of winter, as is the practice in some cases, the mode is to have the fruit rather smaller, and the tree larger, and so much covered with fruit as to allow of but few shoots. These purposes are excellently accomplished in this way in many places.

Standard forest-trees of all sorts, and deciduous and ever-green standard shrubs, should mostly, when for ornament, be planted out singly, or among clumps or groups of low plants,

so as to produce the best and most suitable effects, according to the nature of the situation or place, and the kind of tree or shrub which is employed for the purpose.

STANDARD Timber-Trees, all such deciduous and other trees as are raised in woods and other places, trained and left for the purpose of forming timber. See TIMBER.

STANDENHEIM, in *Geography*, a town of France, in the department of the Rhine and Moselle; 9 miles W.S.W. of Creutznach.

STANDIA, called also *Dia*, an island of the Mediterranean sea, situated three leagues N.E. by E. of Candia. It is about four miles long by two broad; its circumference is irregular; in its south parts are three natural harbours, where ships of burden, bound to Candia, cast anchor and unload a part of their cargo, because the harbour of that town is not deep enough to receive them when they are fully laden. On their departure they also go and wait at Dia till boats bring them commodities for completing their lading. The middle harbour, called "Porto della Madona," is the best of the three; a vessel may cast anchor there in from six or eight fathoms water up to a considerable depth. On doubling the E. point a fourth harbour occurs, by no means safe, rather shallow and open to the E. wind, but sheltered from the S.W. and N.W. Here a merchant vessel, caught in a gale of wind, might take refuge. This island is lofty, rugged, and entirely calcareous. The rock is naked, except towards the summit, where the soil seems to be fit for the culture of the vine and the olive-tree. In various places a whitish marble is found; and here are also veins, several feet thick, of streaked alabaster, which is thought to be of the greatest beauty. Rabbits are numerous in this island; and it has some wild goats, in places that are inaccessible, and also several cats of different colours, that probably belonged to vessels which have been cast away. N. lat. 35° 26'. E. long. 25° 9'. Olivier.

STANDIA, a town of European Turkey, in Macedonia, in a small bay of the gulf of Saloniki; 13 miles N. of Larissa.—Also, a town of Asiatic Turkey, in Natolia, on the W. coast. N. lat. 36° 54'. E. long. 27° 18'.

STANDING, in *Navigation*, denotes the movement by which a ship advances towards a certain object, or departs from it: as the enemy stands in shore, the English fleet are standing-off, &c.

STANDING, in *Ship-Building*, a term applied to a bevelling that is obtuse-angled, or without a square.

STANDING Army. See ARMY.

STANDING Coins. See COINS.

STANDING of Colours, is used by painters for their durability, in opposition to *flying*.

STANDING Fold, in *Agriculture*, a term applied to that sort of fold, made for containing and protecting sheep, which is of the fixed and immoveable kind, in contradistinction to those which are of a moveable nature on land of the arable or grass kind. See *FOLDING of Sheep*, and *SHEEP-Fold*.

In Suffex, the standing fold of the late general Murray is stated to have been well contrived and formed. It comprised an inclosed area of fifty-seven yards in length, and twenty in breadth, containing one thousand one hundred and forty square yards: more than seven hundred ewes were usually folded in it during the night, and for that number, it afforded a space of more than a yard and a half for each sheep. It had all around it a shed, nine or ten feet wide, and likewise across the middle part, which latter was open on both sides. There was also a rack for hay put up against the wall, which was boarded, and surrounded the whole of the

the fold: and another, which was double, to be eaten out of on both sides, was placed and stood all along the central shed; under which was a small trough or manger, in which the fine sorts of food given to the sheep were put. This was, of course, a most complete and perfect standing fold for managing and protecting these animals, the plan of which may probably in some measure be imitated by other sheep-farmers with considerable utility and benefit.

STANDING Marriage, in the *Law* of Scotland, is used to express one actually subsisting, though perhaps reducible for adultery, or liable to be declared void for impotency, or contingency of blood; that is, consanguinity. *Bayne's Crim. Law*.

STANDING Part of the Sheat, in a *Ship*, that part of it which is made fast to a ring at the ship's quarter. When they say, *over-hale the sheat*, they mean, *hale upon the standing part*; but when they say *hale the sheat* barely, they intend only of the running part.

STANDING Part of a Tackle, is the end of the rope where the block is seized or fastened; as the other which is haled is called *fall*.

STANDING Rigging, are those ropes which do not run in any block, but are set taught, or let slack occasionally, as the shrouds, stays, back-stays, &c.

STANDING Ropes. See *Standing Ropes*.

STANDISH, in *Geography*, a post-town of America, in the district of Maine, on the W. line of Cumberland county, between Presumpscot and Saco rivers; incorporated in 1785, and containing 1378 inhabitants; 18 miles N.W. of Portland.

STANDON, *STANTON*, or *Stancelow*, is a small market-town and parish in the hundred of Braughin, county of Hertford, England, at the distance of one mile S.E. from Puckeridge, and 26 N.N.E. from London. It is mentioned by Ingulphus as having been granted to Croyland abbey in the early part of the ninth century; and as the place where abbot Brithmere, about the year 1030, built a spacious house for the accommodation of himself and his retinue, during his journeys to London. In this parish also was a preceptory of knights hospitallers, built on lands given with the church to that order by Gilbert de Clare, in the reign of king Stephen: the house was designed for the residence of some of the sisters of that order, till they were all placed together at Buckland, in Somersetshire. The site, and some remains of the preceptory, are now connected with a farm-house called Friars. The manor, rectory, and advowson of the vicarage, as parcel of the possessions of St. John of Jerusalem, were granted 36 Henry VIII. to sir Ralph Sadler. A hermitage was founded at Standon by William, an Anchorite, temp. Henry I.; which Richard de Clare, earl of Hertford, gave to the monks of Stoke by Clare, in Suffolk, who are said to have had a cell here, which in after-times appears to have become a free secular chapel, and to have been the same with the chapel at Salburn in this parish. Standon church contains many monuments and sepulchral memorials. In the eastern part of the chancel are the tombs of sir Ralph Sadler and family: on sir Ralph's is his effigy in armour lying beneath a canopy, with his children kneeling below. He died in 1587, aged 80. The parish of Standon, according to the population return in 1811, contained 1889 inhabitants; the number of houses being 254. A fair is held annually, and a market weekly, on Fridays.

On Haven-End, an eminence in Standon lordship, are two large barrows, supposed by Salmon to have been raised by the Danes. In the neighbouring parish of Widford are two other barrows, which give name to the estate on which they

are raised. *Beauties of England and Wales*, vol. vii. Hertfordshire, by E. W. Brayley.

STANDS, in *Rural Economy*, a word applied to such young timber-trees as are under six inches timber girth, or twenty-four inches in circumference. These are mostly reserved in cutting over young timber and other woods.

STANERN, or *STANAROW*, in *Geography*, a town of Moravia, in the circle of Iglau; 10 miles S. of Iglau.

STANES. See *STAINES*.

STANESBY, THOMAS, in *Biography*, father and son, two ingenious and eminent flute-makers in London during the early part of the last century. The flute a bec, or common flute, was so much in fashion during the life-time of the eldest Stanesby, who died about the year 1734, that no single song was printed without being transposed into C, or F \sharp , for the flute, at the bottom of the page. The younger Stanesby, who died in 1754, lived long enough to see the common flute totally thrown aside, in favour of the German flute, a concert instrument, an honour which never had been conferred on the common flute, except now and then in the accompaniments of a song, such as, "Hush ye little warbling choir," on the octave flute, and perhaps two or three more may be found in Handel's works.

Stanesby, however, conformed to the taste of the times, and furnished practitioners on the flute traversiere, or German flute, with instruments, for which the scholars of Weidiman and Ballicourt, the two first public players on the German flute in our capital, frequently and loudly called.

Poor Stanesby did not enrich himself like Theodorus, a flute-maker at Athens, father of the orator Iocaterus, who acquired wealth sufficient by his employment, not only to educate his children in a liberal manner, but also to bear one of the heaviest public burdens to which an Athenian citizen was liable, that of furnishing a choir or chorus for his tribe, or ward, at festivals and religious ceremonies.

The second Stanesby was buried in the church-yard of St. Pancras, near London, and on his grave-stone there is a very honourable record of the virtues of his private character; a circumstance which biographers should never neglect to mention, as monumental praise is seldom lavished on persons of low station: "Why should the poor be flattered?"

STANFALIA, in *Geography*. See *STAMPALIA*.

STANFORD, or *STAMFORD*, is an ancient market and borough-town, situated at the south-western angle of the county of Lincoln, England, on the banks of the river Welland. One parish of the town is in the county of Northampton; but the chief portion of it is built on the side of a hill in Lincolnshire, and when approached from the south, presents an interesting and picturesque appearance. Several old buildings, with towers and steeples, are seen grouped together. The name of the town is supposed to be derived from the Saxon *Staan*, and *ford*. According to some antiquaries, Stanford was a place of note in the time of Bladud, a British king, many centuries before the Christian era. The earliest authority upon which we can depend, is that of Henry of Huntingdon, a writer of the twelfth century; who relates, that the ancient enemies of England, the Picts and Scots, having ravaged the country as far as Stanford to the south, were there met and defeated by the Saxons under the command of Hengist; and that king Vortigern, for such valour, gave to the Saxon leader certain portions of land in the county of Lincoln. Wulphere, king of Mercia, who finished the monastery of Medeshamsted, now Peterborough, in a charter of lands to that abbey in the year 664, assigned Stanford as one of its boundaries; and as it rose progressively in importance, so in the year 972, in another charter to the same

fame house by Edgar, it appears to have been more considerable than Peterborough. At that period it was a market-town, and is noticed by Leland as afterwards becoming a royal borough: under the Danish monarchy it appears still to have maintained the rank which it originally claimed. That it was encircled by walls, and secured by gates at an early period, is evident from the Saxon annals terming it *Byrnigh*; Florence of Worcester, *Arx*; and by Speed's plan, where each is named and delineated. A castle was probably erected here by the Danes, as the above-mentioned historian, Henry of Huntingdon, notices their loss of it in the year 942 to Edmund Ironside, and remarks, that it had then been a considerable time in their possession. Leland, who, on the other hand, adheres to Matthew of Westminster, states that it was rebuilt by Elfreda, sister of Edward the Elder, on the northern bank of the Welland, A.D. 914. Again being possessed by the Danes, they held it till the decease of their last Anglo monarch, A.D. 1041, when the Britons once more became its owners, till William the Norman overcoming the kingdom, in 1066, it devolved to the new monarch and his retainers. The Domesday survey informs us, that it contained one hundred and forty-one mansions, and twelve lagemen, or civil magistrates, who received the forfeitures arising from crimes, and held their powers within certain limits. The castle, in the time of king Stephen, was besieged by Henry of Anjou, afterwards the second monarch of that name, who upon taking it bestowed that and the town, with certain feudal reservations, on one of his followers, called Richard Humetz, to hold from the crown by homage, tenure, and other services. King John passed them to William, earl of Warren, in a similar manner: at his death they were granted by John, who was also earl, to Edward I., and passed by him again to that nobleman, to revert on his decease once more to the crown. Thus, after many grants and reversions through forfeiture or failure of male issue, it was given by queen Elizabeth to William Cecil, first lord Burleigh. Through the marriage of his coheirs and granddaughter, Anne, with William, earl of Exeter, it passed to Henry Grey, first lord Stamford, and after continuing in that family several descents, was sold again to the house of Cecil. In Richard III.'s time the castle was entirely demolished; and the hill, which was artificially formed by horizontal layers of earth, with the slight fragments of a stone wall, are all the vestiges that are now visible.

In William the Conqueror's reign, Stamford was governed by the lagemen, or aldermen. Edward IV. gave it a privilege it still retains, of sending two members to parliament, and a charter was granted in the first year of that king's reign, when its civic officers were incorporated under the names of the "aldermen and burgesses of the first and second bench." Other charters conferred different privileges in succeeding reigns, till Charles II. recalling the royal charters throughout the kingdom, gave a new one to Stamford, which was afterwards confirmed by James II. Again incorporated by that deed, it was made to consist of a mayor, thirteen aldermen, and twenty-four capital burgesses, by the name of the "mayor, aldermen, and capital burgesses, of the town or borough of Stamford."

For parochial and municipal purposes, Stamford appears to have been divided, at a remote period, into fourteen wards, or parishes; but in 1461, some of the churches and houses were consumed by fire, by the northern soldiers; and the religious edifices were not afterwards re-erected. In 1547, an act of parliament was obtained to divide the northern part of the town into five parishes, St. Martin's, or Stamford-Baron, being a distinct parish. According to the population report of 1811, the borough contained 832 houses,

and 4582 inhabitants; and the parish of St. Martin's 163 houses, and 937 inhabitants.

St. Michael's church, which stands near the centre of the town, is supposed to be the most ancient erection, part of it having existed antecedent to the year 1230. It has a nave and choir, with north and south aisles, and chancels which extend beyond the aisles. The eastern end of the choir, which had much decayed, was, about 1705, taken down and rebuilt by the parishioners: in the wall were discovered various sculptured stones, the remains of some more ancient religious building. At the western end of the nave was a wooden tower, which was taken down and replaced by another of stone in 1761. The windows of this building were decorated with figures and heraldic ornaments, but it is much to be regretted that they are in a lamentable state of mutilation.

The church of St. Mary appears to have been built towards the latter end of the thirteenth century, and possibly upon the site of one much earlier. The upper part of the chancel contains a monument without armorial ensigns, device, or inscription, but simply consisting of a statue in armour, lying by the side of a female figure. This was erected to the memory of sir David Phillips, who bravely distinguished himself in the battle of Bosworth Field.

St. George's church, a large plain building, consisting of a chancel, nave, north and south aisles, with a square embattled tower at the west end, was rebuilt, in 1450, by William Bruges, the first garter king of arms, who bequeathed many valuable presents to this building. The remains of David Cecil, high sheriff of Northamptonshire in 1542, grandfather of the first lord Burleigh, are here entombed.

All-Saints church is a structure well proportioned, and of large dimensions: it consists of a nave, two aisles, and chancels; one at the end of the south aisle, and the other at the east end of the nave. At the west end of the north aisle rises the steeple, a lofty, handsome structure, embattled, with octagonal turrets at the corners, and surmounted by a spire of a similar form, crocketed at the angles from the base to the summit. This church was built at the expence of a Mr. John Brown, merchant of the Staple at Calais, who, with his wife, are buried at the upper end of the north aisle. In the same church, where the altar formerly stood, are the effigies of William Browne and his wife, who built and endowed the bead-house in this town. Against the east window, a white marble monument preserves the memory of Mr. Thomas Truefsdale, who lived in the same dwelling with Mr. Brown, and emulated his example, by founding another alms-house.

The church of St. John the Baptist was rebuilt about 1452, the thirtieth year of the unfortunate Henry VI. It has a nave, and two aisles, with a chancel at the east end of the first, and separated from it by elegant screen-work. The roof has been highly decorated with figures carved both in wood and stone; and the windows contained some admirable specimens of stained glass.

Stamford formerly contained several monastic establishments; and it is traditionally related that it was, at one time, the seat of an university. Hardinge, in his Poetical Chronicles, and in "The Mirror of Magistrates," relates the latter circumstance; but this is not authenticated by better historians. The only circumstances which appear to support the idea of an university are, that in the year 1109, Joffrid, abbot of Croyland, deputed three monks from his monastery for that purpose. Camden remarks, that a violent dispute arose between the northern and southern scholars at Oxford, in 1333, when many of the masters and students

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retired to Stanford. Several of these, however, soon returned to Oxford; and some time afterwards, Edward III. issued a writ to the sheriff of Lincolnshire, commanding him to proclaim at Stanford a prohibition for any person to study or perform scholastic exercises, elsewhere than in the universities, on pain of certain forfeitures.

In the reign of Henry III. the Carmelites had a monastery here, and gave public lectures on divinity and the liberal arts, with disputations against the Judaic faith. Many of the clergy and higher orders of the people sent their sons here for education; and from this possibly arose a custom, which in succeeding centuries was greatly followed. Other religious houses also became schools of literature; and by these means Stanford became celebrated for liberal instruction. The other public institutions of learning, which were supposed to constitute part of the above-mentioned university, were the following:—Brazen-nose college or school, from which the college at Oxford is supposed to have derived its name, was built at a remote period, and certainly existed early in the reign of Edward III. In 1668 it was taken down, and a charity-school erected on the same spot:—Sempringham-hall, supposed to have been founded by Robert Luttrell, in 1262:—Black-hall was of great antiquity, and was taken down soon after 1705.

Of Peterborough-hall, Vaudey-hall, the free-school, and other buildings of the same nature, but slight information can now be gained, excepting that the former was taken down about 1705, and stood near All-Saints church; and that the latter was founded in the year 1548, by Mr. William Radcliffe.

The schools at present supported at this place are, the one last mentioned, now called Radcliffe's; another instituted by Edward Wells, in 1604, denominated Wells's or the petty school; and the blue-coat school.

The ancient and modern institutions for the support of the poor are many in number: the most prominent, is one founded by William Browne in the reign of Richard III., already mentioned, which has a chapel at the eastern end, consecrated in 1494; the revenues of which have, of late years, greatly increased. Another was erected by the will of Mr. Thomas Truefdale, in 1700, with endowments bequeathed to it for ever. And, in addition to these, are certain charities denominated callises; with various other foundations of the like nature.

The principal public building is the town-hall, where the civil business is transacted. It was built by trustees, under an act passed in 1776, near St. Mary's church, when the old hall was taken down. It consists of two handsome fronts, containing twenty apartments, a guard-room, house of correction, and a gaol. A small theatre, in St. Mary's street, was built here in 1768.

The river Welland, which runs to the south of the town, and parts it from Stanford-Baron, is navigable for boats and barges from the sea to this place. Stanford has a market on Monday and Friday, and seven annual fairs.

Stanford-Baron, already named, is separated from the town only by a stone bridge, yet it is both a distinct parish and liberty in the county of Northampton: hence its original name of Stanford beyond the bridge. In 1455 it was held by the abbot of Peterborough, *per baroniam*, and was then first denominated Stanford-Baron. In the reign of Athelstan it had the privilege of a mint, and succeeding kings also greatly favoured it. Although it cannot now be discovered that this parish was ever walled, yet it appears to have been defended by five gates and a castle, which stood on that part of the Roman road now called the nun's farm. This place is designated in the Domesday-book as

being the sixth ward belonging to Stanford, situate in Hantunescire. In the reign of Henry II. it contained a Benedictine nunnery, dedicated to God and St. Michael, by William, abbot of Peterborough: the annual revenues of this house were 7*l.* 18*s.* 10½*d.*

By a deed of the reign of Richard I. notice is taken of an hospital for lepers, under the patronage of St. Egidius; and a house for knights hospitallers: but their founders are now wholly unknown. Where the alms-house is now erected, an hospital formerly stood, dedicated to St. John the Baptist. The present church is a large, handsome building, dedicated to St. Martin, and founded by bishop Russell in the reign of Edward IV. It consists of a nave, two chancels, north and south aisles, and a square pinnacled tower at the west end of the former. At the upper end of the north chancel are deposited the remains of Richard Cecil and his wife, the immediate progenitors of the first lord Burleigh; as also those of William Cecil, baron of Burleigh, with his effigy in armour on a highly ornamented altar-tomb. In the north chancel is a stately and large marble monument, with statues, &c. to the memory of John, earl of Exeter, and his lady, both of whom died in the year 1709.

According to Camden, the custom of borough English prevails in this manor; by which the younger son inherits the lands and tenements possessed by the parent, when the latter dies intestate. Another more singular custom, characteristic of feudal and semi-barbarous times, is still continued at Stanford. On a certain day, annually, about six weeks before Christmas, a bull is provided, and destined to be hunted by dogs and the lowest class of persons through the streets of the town. On such occasions a vast concourse of people is assembled, many dogs are brought to the place, and the most cruel and wanton acts are resorted to, in order to irritate the poor animal, and thereby produce what is mis-termed sport. The bull-running, as it is called, commences early in the morning, after a proclamation is made to guard doors and windows, and warn travellers who are passing through the town. The animal is let loose in the streets, when dogs, men, women, and even children, commence a boisterous and irritating pursuit. This is sometimes continued for hours, till the bull is provoked to madness. At length he is killed, and the flesh sold. It is traditionally related, that this custom originated in the reign of king John, by the order of William, the fifth earl of Warren, who, having observed a bull worried through the town by dogs, was so much diverted, that he gave a meadow to the butchers of Stanford, on condition that they would provide a bull annually for the same purpose. A custom somewhat resembling this prevails at Tutbury, in Staffordshire. See TUBURY.

About one mile south-east of Stanford is Burleigh or Burghley-house, the magnificent seat of the Cecil family, and now the property of the marquis of Exeter. The park was inclosed and house chiefly built by lord-treasurer Burleigh, who, in a letter dated 1585, says, the "house is of my mother's inheritance; and for the building there, I have set my walls on the old foundations." On different parts of the edifice are the dates of 1577, 1585, and 1587, pointing out the times when such portions of the house were raised; but many additions and alterations have been made at subsequent periods. The whole presents a palace-like appearance, and may be said to consist of a mass of building surrounding a square court 110 by 70 feet. In various rooms is preserved a large collection of pictures by different old masters, with some few paintings by modern artists.

The park is of great extent, of varied surface, is adorned with

with much fine timber, a large piece of water near the south front of the house; and at the western extremity, adjoining the great North road, is a stately lodge of entrance, which was erected in 1801, from the designs of Mr. Legg, architect. An interesting account of this seat, with a particular catalogue of the pictures, was published at Stanford, in 1815, entitled "A Guide to Burghley-House," &c.—Survey of the Town of Stanford, by Butcher, 8vo. 1717. An Essay on the ancient and present State of Stanford, by Howgrave, 4to. 1720. Antiquarian Annals of Stanford, by Peck, folio, 1727. The Antiquities of Stanford and St. Martin's, by W. Harrod, 2 vols. 12mo. 1785. An Account of the public Schools, Hospitals, and other charitable Foundations, in the Borough of Stanford, by Thomas Blore, 8vo. 1813. This is a very interesting and useful work, as calculated to preserve and give publicity to those benevolent institutions, which were originally intended to afford support to the aged poor, and instruction to the lower classes of youth.

STANFORD, a post-township of Duches county, New York, about 18 miles N.E. of Poughkeepsie; incorporated in 1793, and containing 2335 inhabitants. This township is well watered and cultivated; has many able farmers, several mills, three houses for worship, *viz.* for Quakers, Baptists, and Methodists. In 1810, its household looms produced 12,680 yards of cloth. Its sheep were 5564, horses 811, and cattle 2898.—Also, the capital of Lincoln county, Kentucky; situated on a fertile plain, about 10 miles S.S.E. of Danville, containing a stone court-house, a gaol, and about 40 houses.

STANG, a river of Sweden, which runs into lake Roxan, near Linkioping.—Also, a town of Norway; 24 miles N. of Berga.

STANG, in *Rural Economy*, a word provincially signifying a long pole, or other piece of wood in the same form. Stangs are useful for a variety of different purposes in the practice of farming.

STANG-Cart, in *Agriculture*, that sort of stang which constitutes the shafts of a cart, or the poles between which the horse draws. See CART.

STANGENBERG, in *Geography*, a town of Prussia, in Pomerelia; 15 miles S.E. of Marienburg.

STANGENGRUN, a town of Saxony, in the circle of Erzgebirg; 9 miles S.W. of Zwickau.

STANGENROD, a town of Westphalia, in the county of Mansfeld; 13 miles N.N.W. of Eifzleben.

STANGSKAR, a small island in the gulf of Finland. N. lat. 59° 45'. E. long. 26° 15'.

STANGWYK, a town of Norway, in the province of Drontheim; 80 miles S.W. of Drontheim.

STANHOPE, GEORGE, in *Biography*, an eminent divine of the church of England, was born at Hartshorn, in Derbyshire, in 1660. He was educated at Eton, and King's college, Cambridge; and after taking his degrees, and bearing some offices in the university, he was presented by lord Dartmouth, in whose family he had been chaplain and tutor, to the rectory of Lewisham, in Kent. He was appointed one of the chaplains to king William and queen Mary, and retained the same office in the following reign. In 1697 he proceeded doctor in divinity, and being at the same time distinguished for his pulpit eloquence, he was chosen, in 1701, to preach Boyle's lecture; and in 1703 he was promoted to the deanery of Canterbury. He sometimes preached the lecture at St. Laurence Jewry, in which he attained to great eminence, though he followed many persons of much celebrity. In 1705 he preached the Latin sermon before the convocation, of which body he was thrice

chosen prolocutor. He died in 1728, at the age of 68. Of the publications of this learned divine, some were translations: these were "Thomas à Kempis de Imitatione Christi;" "Charron de la Sagesse;" "The Meditations of Marcus Antoninus;" "Epictetus, with the Commentary of Simplicius;" "Rochefoucault's Maxims;" "St. Augustine's Meditations." His most considerable original work was "A Paraphrase on the Epistles and Gospels," 4 vols. 8vo. several times reprinted. He also published three sets of "Sermons on several Occasions;" besides "Sixteen Sermons preached at Boyle's Lectures."

STANHOPE, PHILIP DORMER, earl of Chesterfield, a nobleman celebrated as a great wit, statesman, and a man of letters, was the eldest son of Philip, third earl of Chesterfield, by lady Elizabeth Saville, daughter of George, marquis of Halifax. He was born in London, in September, 1694. He had the misfortune to lose his mother while he was very young, and being neglected by his father, he was educated under the care of his grandmother, lady Halifax, who proved herself quite adequate to the task. His elementary instructions were received at home from able masters, who had the advantage of finding in their pupil admirable qualities, and an ardent desire of excelling in whatever he undertook, and a resolution to persevere in the tract in which he entered, without any regard to the obstacles that might oppose themselves to his progress. It is said that lord Galway, discerning in him, when very young, a strong inclination for political distinction, and at the same time a great love of pleasure, with a propensity to sauntering, gave him a friendly lesson on the absolute necessity of rising early, in order that he might become a man of business. The admonition produced such an effect on his mind, that he immediately adopted the practice recommended, and adhered to it during the whole of his life. He was afterwards, by a trifling incident, permanently cured of an impatience of temper, which he was sensible would disqualify him for the character and duties of a statesman. In his 18th year he was entered of Trinity-hall, Cambridge, where he applied himself with great assiduity to the studies pursued in that seat of learning. He was particularly attentive to eloquence, which he was aware was a principal requisite in a free senate; and with the view of becoming a good and a forcible speaker, he marked down all the finest speeches of the ancients that came in his way, in the course of his reading, and formed his own style and manner by translating them; a practice which cannot be too warmly recommended to young men likely to come into public life. On quitting the university, this young nobleman made the usual tour of Europe; and it was at the Hague that he first began the cultivation of that enlarged acquaintance with mankind, which has been denominated seeing and knowing the world; but with this knowledge he acquired certain pernicious propensities, which adhered to him through life: among others was that of gaming. A visit of some length to Paris further contributed to fashion his manners, and to render him at length that model of true politeness, which he exhibited in after-life to his admiring countrymen. This was about the time of the demise of queen Anne, and he did himself high honour by the assertion of those principles of freedom which effected the succession of the house of Hanover, and which, during the whole of his political life, he steadily maintained. On his return to England in 1715, he was presented to the new sovereign, and appointed one of the gentlemen of the bed-chamber to the prince of Wales. He was elected member of parliament for one of the Cornish boroughs, in the first parliament of George I., and commenced a speaker in the debate respecting the impeachment of

of the persons concerned in the peace of Utrecht. Upon this occasion he manifested a juvenile violence, which produced an intimation from the opposite side, that advantage would be taken of his being under the lawful age for sitting in parliament. Upon this hint he immediately quitted the house, and set off for Paris. On his return, he was sometimes the defender and sometimes the opponent of ministerial measures; but his talents, at this time, do not appear to have made much impression on the house or the country. In reward, however, for his support of a motion for the augmentation of the army, he was, in 1723, made captain of the yeomen of the guards; and it was a proof of his disinterestedness, that when advised by his predecessor, lord Townshend, to make the post more profitable than he had done, by the sale of subordinate places, he replied, "I rather wish, in this instance, to follow your lordship's example than your advice." He was dismissed from this office in 1725; and in the following year, on the death of his father, with whom he had never been on terms of cordiality, he entered the house of lords, and joined the opposition. To this assembly his talents were better adapted than to the house of commons. His eloquence, the fruits of much study, was less characterized by force and compass than by elegance and perspicuity, and especially by good taste, and a vein of delicate irony, which, while it sometimes inflicted severe strokes, never passed the limits of decency and propriety. "It was that of a man, who, in the union of wit and good sense with politeness, had not a competitor." These qualities were matured by the advantage of a familiar acquaintance with almost all the eminent wits and writers of his time; many of whom had been the ornaments of the preceding age of literature, while others were destined to become those of a later period. He knew how to appreciate genius and talents, and was the friend of Pope, and received him in almost all his select parties at Twickenham, where he met the first nobility in association with the most distinguished votaries of the muses.

Soon after the accession of George II. lord Chesterfield was nominated ambassador at the Hague. Scarcely was any man ever better adapted than his lordship to fill a diplomatic situation, as well on account of his natural acuteness, and of his conciliating manners, as his familiarity with the modes and usages of general society. He was, however, at this time but little acquainted with public business; but possessing the laudable ambition of rendering himself fully master of whatever he undertook, he spared no pains to acquire the knowledge for the post in which he was placed, and which at that time was a very important one; the Hague being, in fact, the centre of the principal political negotiations carrying on throughout Europe. In the year 1730 he was appointed high steward of the household, and he was, at the same time, decorated with the order of the garter. He now returned to Holland, and was instrumental in forming an important treaty between the courts of London and Vienna, and the States-general. In 1732 he obtained his recall; and on his return, he supported the plans of the prime minister, though there does not appear to have been any cordiality between them; and when sir Robert Walpole introduced his famous excise measure, the earl spoke against him with all his force, and thereby gave so much offence that he was deprived of his offices, and he again joined the party in opposition. He married, in 1733, the countess of Walsingham, niece or probably daughter to the duchess of Kendal, who had been mistress to George I. She was a lady of great merit and accomplishments, and by her prudence contributed very much to retrieve the deranged affairs of her lord. The noble earl did not neglect to pay his

court to the prince of Wales, who attached himself to the opposers of his father's government. Of his oratorical exertions, none was more generally admired than his speech against the bill for granting to the lord chamberlain the power of licensing dramatic performances. In 1741, his health being much impaired, he was advised to make the tour of the continent. In his way to the Spa, he saw, at Brussels, Voltaire, with whom he had contracted a friendship in England. At Spa his reputation, and the urbanity of his manners, drew upon him much flattering notice from persons of distinction; and the manner in which he spoke of the rising Frederick of Prussia to the envoy of that monarch, procured for him a pressing invitation to the court of Berlin, which he would gladly have accepted, had he not been prevented by other engagements. A short stay at Paris introduced him to the most distinguished of both sexes for rank and talents in that capital, where he was equally gratified and admired.

His stay in the south of France was shortened by the state of political affairs at home. The attempts of France to ruin the house of Austria were threatening destruction to what was denominated the balance of power in Europe; and the miscarriages of the English ministers in their political measures spread discontent through the nation. This at length produced the fall of that statesman, who had so long ruled the public councils; and a new administration was formed, in which lord Chesterfield had no place. This omission was probably owing, in great part, to the personal dislike of the king, who could not forget the severe things he had said with respect to the royal partiality to the interests of Hanover, and the sacrifices made of the interests of Great Britain to those of the electorate. He took an active and most decided part in opposition to the measures of the ministry, and was said to be particularly happy in his speech against the gin-licence bill, and against that for continuing attainders upon the posterity of persons convicted of high treason. This last bill was introduced in consequence of the prospect of a new rebellion, promoted by France, and which soon after took place. This event produced a change in the ministry, and lord Chesterfield was sent out as ambassador to the United Provinces; a station which he had before occupied with much reputation. He effected the purpose for which he was sent, *viz.* that of engaging the Dutch to concur in earnest in the war against France; and returned in 1745, at the time of the breaking out of the rebellion in Scotland. He was immediately nominated to the high station of lord lieutenant of Ireland; an office of great importance at this period, when there was cause of apprehension from the prevalence of the Roman Catholic religion in that island. He set off for his government in the end of August, taking with him a secretary, who had not enjoyed any advantage from experience, and to whom he said in a tone of decision, "Sir, you will receive the emoluments of your place, but I will do the business myself, being determined to have no first minister." In a similar spirit he openly declared, that if any one, during his stay in Ireland, should make a successful application for a place in the king's gift through any channel but his own, he would immediately throw up the lieutenancy. With these resolutions he began his administration; and by vigour on the one hand, and conciliation on the other, by strict integrity, and a frank undisguised system of policy, he kept every thing quiet in that kingdom, while the sister island was over-run with terror and commotion. Instead of abridging the Catholics of their religious liberty, he favoured and augmented it; wisely judging, that the more openly they shewed themselves in attendance at their own

places of worship, the less their secret machinations were to be regarded. He, however, kept a vigilant eye upon all their proceedings, but discouraged idle suspicions and malicious informations. A zealous Protestant once came, very officiously, as the noble lord thought, to inform him that one of his coachmen went privately to mass. "Does he?" said the lord lieutenant: "I will take care that he never drives me thither." Such, says his biographer, was lord Chesterfield's conduct in his vice-royalty, that he quitted it with the regret of all parties; and that, to this day, the spirit of his administration is regarded as a model for all who are entrusted with that important station. He returned to England in April, 1746, when the rebellion was terminated by the victory gained at the battle of Culloden.

He now accepted the office of secretary of state, with the duke of Newcastle as his colleague. Never approving, in his own mind, of the war in which the nation was engaged, and constantly wishing for peace upon reasonable terms, he was nevertheless carried away, by a superior influence in the cabinet, to concur in the measures of the court, till their ill success induced him to draw up a strong memorial, which being disregarded, he resigned his place in February, 1748, and never afterwards joined in any administration. From this period till his death he lived as a private nobleman, attached to the arts and to letters, and was looked up to throughout Europe as inferior to none of his high rank for brilliancy of wit, and the polish of cultivated society. Being seized with a deafness in 1752, that incapacitated him, in a measure, for the pleasures of society, he led a retired life, amusing himself with his books and his pen. He engaged rather largely as a volunteer in a periodical work, entitled "The World," in which his contributions have a distinguished degree of excellence. His lordship maintained a character for wit and talents that has few equals. He rendered himself illustrious, as we have seen, by his eloquence in parliament, on many important occasions, of which there is a characteristic instance of his own relating. He was an active promoter of the bill for altering the style; on which occasion, as he himself relates in one of his letters to his son, he made so eloquent a speech in the house, that every one was pleased, and said he had made the whole very clear to them; "which," says he, "God knows, I never attempted. I could just as soon have talked Celtic or Slavonian to them as astronomy, and they would have understood me just as well." The high character which lord Chesterfield had supported through life received no small injury, soon after his death, from a full display of it by his own hand. He left no issue by his lady, but had a natural son, named Philip Stanhope, whose education was, for many years, a close object of his attention; and who was afterwards envoy extraordinary at the court of Dresden, but who died before his father. After the death of the earl of Chesterfield, Mr. Stanhope's widow published a course of letters, written by the father to the son, filled with instructions suitable to the different gradations of the young man's life to whom they were particularly addressed. These letters have been highly applauded, and as loudly condemned. They contain many admirable observations on mankind, and rules of conduct; but the author lays a greater stress on exterior accomplishments and address than on intellectual qualifications and sincerity, and allows a much greater latitude to fashionable pleasures than sound morality will admit. It has been urged in excuse for the author; that he never intended these letters for publication: they contained instructions for a particular individual, and they do not pretend to touch upon the more weighty points

of morals, these being left to the inculcation of a selected tutor: nevertheless, there is some occasional advice coming under this head, contained in the later letters, when the son was already launched upon the world, which have justly subjected the writer to severe animadversion. Of these, such as relate to truth in the commerce of society, under the distinctions simulation and dissimulation, have been defended and justified by politicians, as absolutely necessary for one who was to be trained to diplomatic habits. But the same apology cannot be made for a father's attempts to fashion his son to politeness, by recommending connections with married women, which, however lightly regarded in the licentious courts and capitals at which he himself had been a visitor and resident, must ever be considered as a most serious violation, not only of the laws of God, but of private friendship, and of the most sacred bond of social life. These obnoxious parts would, in all probability, have been suppressed, had the author revised and published his own letters. On the other hand, there are, in the course of the volumes and the other works of lord Chesterfield, many examples of his useful and efficacious endeavours to serve the cause of morality. His lordship died in March, 1773, in the 79th year of his age. He had for some time been extremely infirm, and having outlived most of his friends and contemporaries, he was in fact reduced to a state in which he rather patiently endured life than enjoyed it. "It is unnecessary," says his biographer, "to add any thing to the view already given of his moral character: if it was very far from faultless, it certainly exhibited many excellencies, which enabled him to perform important services to his friends and country. In his literary capacity, he possessed wit, good sense, and a fine taste, in an uncommon degree. His style is of the purest English." Of his works, which, besides those already referred to, contain papers in some of the political journals of the day, speeches, state papers, and letters, French and English, a Collection, in 2 vols. 4to. with memoirs of his life, by Dr. Maty, was published in the year 1777, to which the reader is referred for more minute information relating to the character, exertions, and works of the earl of Chesterfield.

STANHOPE, JAMES, earl, a celebrated English nobleman, statesman, and general, descended from a very ancient family in the county of Nottingham, eldest son of Alexander Stanhope, only son of Philip, the first earl of Chesterfield, was born in the year 1673. He entered at a very early period into the army, and served under king William in the war against France, during which, and particularly at the siege of Namur, he distinguished himself so much to the king's satisfaction, as to receive from his majesty a company of foot, and soon after a commission as colonel of the 33d regiment. In the war which was undertaken for the purpose of placing Charles II., son of the emperor Leopold, on the throne of Spain, colonel Stanhope, while commanding a regiment of foot, in 1704, at Porta Legra, in Portugal, was surrounded by king Philip's army, and he and his whole regiment were made prisoners of war. Being exchanged, he was in the following year promoted to the rank of brigadier-general, and in the next campaign he gained very considerable reputation at the siege of Barcelona, under the command of lord Peterborough. General Stanhope planned and completed the conquest of the island of Minorca. Having landed about ten miles from St. Philip's fort, on the 26th of August, with 3000 men, the general caused batteries to be erected, and ordered a number of arrows to be shot into the place, in which papers were stuck, written in the Spanish and French languages, containing threats that the whole garrison should be sent to

the mines, if they did not immediately surrender. The garrison consisted of 1600 men, commanded by colonel La Jonquiere. So artfully had general Stanhope drawn up his men, as to impress the minds of the enemy with the idea, that they were besieged by an army of at least 10,000 soldiers. The stratagem had the desired effect. On the third day the garrison capitulated; and so completely mortified was the Spanish governor when he learned the real number of the besiegers, that he threw himself out of a window in despair, and was killed on the spot. La Jonquiere was imprisoned for life, and the other French officers incurred their monarch's displeasure. In 1710, general Stanhope headed the allied troops, killed the Spanish commander with his own hand, and placed the victorious banners of England upon the walls of Madrid; but before the end of the year the general experienced a reverse of fortune, and he, with 2000 choice British troops, were made prisoners of war at the town of Brihuega. On this account he incurred the censure of the house of lords. Soon after the arrival of king George I. general Stanhope was appointed one of the principal secretaries of state, and a member of the privy council. He was also employed in several highly important negotiations. In the year 1717 he was appointed first lord of the treasury, and chancellor of the exchequer; and in a very short time afterwards, he was raised to the peerage of Great Britain. On the 13th of December, 1718, earl Stanhope brought into the house of peers a bill for the repeal of some clauses in the Corporation and Test acts, which, after a violent opposition, was carried through both houses, and received the royal sanction. This nobleman, distinguished in the several capacities of general, statesman, and senator, died in the year 1721, deeply regretted by the king, whose favourite minister he had been, and greatly respected by the nation at large, for whose interests he had ever manifested an unwearied and truly disinterested zeal.

STANHOPE, PHILIP, brother of the foregoing, was brought up to the sea-service, and in 1704 was promoted to the command of the *Hastings* frigate, as successor to captain Charles Parsons. After this he was appointed captain of the *Milford*, in which ship he was serving under sir Stafford Fairborne at the siege of Ollend, and chosen by that commander to bear to England the news of its surrender. Not long after he was sent to the Mediterranean, where he was employed under the command of captain Coney. He continued in the same command during the remainder of his life; which, says his biographer, excessive gallantry, added to a degree of fraternal love almost unequalled, rendered, alas! too short. Frequent mention is made of him in history, and the private journals of officers more particularly connected with him in service and command, as an active, diligent, and intelligent officer. In August, 1708, being left under the command of captain Hubbard, it was determined at a council of war, held on board the *Elizabeth* at the request of the king of Spain, that the *York* and *Milford* should assist in conveying the transports, which had on board lieutenant-general Stanhope and a strong body of troops, from Catalonia to Minorca. The reduction of this island was not only become a very favourite object with the king of Spain, but was regarded as likely to be extremely conducive to the success of the allied cause. General Stanhope, who commanded the land forces destined for this expedition, was, as has been intimated, the elder brother of this gentleman, and the ties of consanguinity appeared to increase the thirst of glory, and stimulated the latter to share with the former in danger, as, though a younger, he appeared a scarcely less ambitious candidate for fame and military glory. Attending the

land-forces as a volunteer at the assault of the Spanish lines at Fort Mahon, he there fell in the moment of victory, on the 17th of September, 1708. Campbell's Admirals.

STANHOPE, PHILIP, earl, son of the foregoing, born the 15th of August, 1714, succeeded to his father's titles when he was only seven years old. He was, by the will of his father, confided to the guardianship of Philip Dormer, the celebrated earl of Chesterfield, of whom we have already spoken. This nobleman, as we have seen, was so strongly attached to the study of the belles-lettres and classical pursuits, as to hold very cheap every other species of learning; and in conformity with this disposition, he absolutely prohibited his young relation and ward from mathematical studies, for which he manifested, while very young, a natural and strong attachment. Notwithstanding this injunction, the young lord, when advanced to more mature years, applied himself to his favourite study with so much avidity, as to become one of the first mathematicians of the age. His predilection, however, for the sciences, properly so called, did not prevent him from attaining the most profound and extensive knowledge of the ancient classics. At no very advanced period of his life, he was a complete master of the Latin and Greek languages, and could, without the smallest hesitation, repeat the whole of the *Iliad*, and the *Odyssey* of Homer, in the original language. He diligently cultivated an acquaintance with the poets and historians of antiquity through the whole of his life, spending several hours of each day either in classical reading, or in the investigation of theorems in the higher and more sublime branches of geometry. Earl Stanhope acquired, likewise, a complete knowledge of many modern languages, in which he could maintain a conversation with as much fluency, as if they had been his vernacular tongue.

A person so formed for the pursuits of literature and science in all its various branches, would, it may be easily conceived, have no great ambition to be distinguished as a politician and statesman. He was, in truth, a man of the most undeviating integrity, and his principles could in no instance be brought to bend to circumstances, nor be swayed by any motives from the strict line of rectitude. In the year 1742 we find him in his place in the senate, when the several estimates of the expence occasioned by foreign troops in the pay of Great Britain were taken into consideration. His lordship then, at the close of an excellent and pathetic speech, moved for an address to advise and beseech his majesty, "that, in compassion to his people, already loaded with such numerous and heavy taxes, such large and growing debts, and greater annual expences than the nation at any time before had ever sustained, he would exonerate his subjects of the charge and burthen of those mercenaries, who were taken into the service last year without the advice or consent of parliament."

Earl Stanhope's name is likewise enrolled among those of many other patriotic noblemen in several protests against measures, which appeared to his mind hostile to the constitution of his country, and the real interests of public liberty. It was either in the earlier attempts made by the ministers of his present majesty to subjugate America, or on the question of the Middlesex election, that this nobleman travelled from Geneva, where he resided several years, to give his vote against the measure, and finding his exertion of no avail, he soon after returned to the continent, to enjoy domestic privacy among his family and his books. At this period his lordship, whose dress always corresponded to the simplicity of his manners, was once rather rudely prevented from going into the house of peers by a door-keeper, who was unacquainted with his person. Lord

Stanhope persisted in endeavouring to get into the house, without stopping to explain who he was: and the door-keeper, determined also on his part, made use of these words: "*Honest man*, you have no business here:—"*Honest man*, you can have no business in this place."

In 1774, earl Stanhope took his leave of Geneva, where he had spent about ten years, greatly respected and beloved by all the respectable people of that city. His lordship's extensive hospitality and beneficence are still remembered with affection and gratitude by many of the inhabitants of that small republic. From this period his lordship took but a very small share in the public transactions of the country. He divided his time between his town residence and his seat at Chevening, in Kent, devoting himself closely for several hours in the day to classical and mathematical studies, which had long become his habitual amusement.

It is to be deeply regretted, that learning so profound and talents so rare should have been applied almost entirely to his own gratification, and that he had not consecrated part of his time to the publication of the result of those researches, which engaged his attention for more than half a century. To his lordship's munificence, however, the public are indebted for the posthumous works of Dr. Robert Simson (see his article); which were printed at his own expence, and a copy or copies of which were sent to every learned society in Europe, and also to many of the most distinguished mathematicians both of his own and foreign countries. It appears, likewise, that Dr. Simson was indebted to this nobleman for the ninety-eighth proposition of Euclid's data. To him also the public are under considerable obligations for the most complete and magnificent edition of the works of the illustrious Archimedes, which was prepared for the press by the learned Joseph Torelli of Verona, and which was printed in 1792, at the Clarendon press, Oxford.

From the circumstance of many valuable works of science being dedicated to earl Stanhope, the subject of this article, among which were Dodson's Logarithms, and the third volume of Dr. Priestley's Experiments on Air, and other branches of Natural Philosophy, we may infer that he was the patron of several learned men. His lordship died the 7th of March, 1786, leaving behind him a son, the present earl, well known in the political as well as the scientific world, and a widow, with whom he had lived forty-one years. This lady, who survived the earl twenty-three years, was Grizel, the daughter of viscount Binning, sister of the late, and aunt to the present earl of Haddington. She was endowed with a fine understanding, which she had cultivated and improved by the constant perusal of the best authors in the English and French languages. She died, in the full possession of her faculties, at the advanced age of ninety-six. It is a remarkable fact, that a year or two previous to her decease, she cut a set of new teeth, and had her hair renewed. She devoted much of her long life to acts of benevolence. The writer of this article was honoured with her acquaintance, and he hopes he may add with her friendship, during ten years of his life, and he will never cease, while in possession of his mental faculties, to reverence her memory, and to hold in high estimation her talents and virtues.

STANHOPE, in *Geography*, a market-town and extensive parish in the N.W. division of Darlington ward, in the county palatine of Durham, England, is situated on the northern banks of the river Wear, 21 miles W. from Durham, and 264 N.N.W. from London. The privilege of a market was granted by cardinal Langley in the year 1421, and having fallen into disuse, was revived by letters patent

in 1669, through the influence of Dr. Bafire, the then rector, and is now held on Fridays. Here were two annual fairs, but they are discontinued. The church is an ancient, plain structure, standing on a rising ground to the north of the town. The rectory is worth about 2000*l.* per annum. On the west side of the town is an eminence, called Cattle-Hill, which rises from the Wear to the height of 108 feet. The summit is of an oblong figure, thirty paces in width, divided by a ditch: another ditch defends the acclivity to the north and east, where the ascent is easiest. It is traditionally said to have been a fortress of remote origin, demolished during the incursions of the Scots. The parish of Stanhope, besides the town, includes the districts of Stanhope-Forest Quarter, and Stanhope-Park Quarter, as also the township of Newlandside. The whole, according to the population returns of the year 1811, contained 1011 houses, occupied by 6376 persons, most of whom are employed in the neighbouring lead-mines. Near the town, on the north, is a cavern, extending under ground nearly a mile, and said to abound with stalactites.

At a short distance west of the town is a spacious old fabric, called Stanhope Hall, formerly the manor-house of the ancient family of Featherstonehaugh, the last of whom was slain at the battle of Hockley.

Stanhope park, a large tract of elevated land, about twelve miles in circumference, is an appendage to the see of Durham, where the bishop anciently held his great forest-hunts, and had his master of the forest, his bow-bearer, and other subordinate officers. Leland mentions this park as being "rudely inclosed with stone."

St. John's Weardale is only a chapelry to Stanhope, but has the privilege of a market, established for the benefit of the workmen employed in the lead-mines. It is seated in a narrow part of the vale, on the south of the Wear. Beauties of England and Wales, vol. v. by John Britton, F.S.A. and E. W. Brayley.

STANHOPE *Presb.* See PRINTING.

STANIHURST, RICHARD, in *Biography*, a divine and historian, was born at Dublin about the year 1545, of which city his father was recorder. He was educated at the University college, Oxford, after which he came to London, and studied the law in Furnival's Inn, and then at Lincoln's Inn. Returning to Ireland, he practised some time at the bar; but having abandoned the Protestant for the Roman Catholic religion, he thought it necessary to remove to the continent, for the purpose of obtaining a freer exercise of the duties which he owed to his Maker. After this he entered into orders, and became chaplain at Brussels to Albert, archduke of Aultria. He died in 1618, having obtained a very high reputation for learning. His writings are enumerated as follow: "Harmonia, seu Catena dialectica in Porphyrium;" "Descriptio Hibernicæ," inserted in Holinghed's Chronicle; "De Rebus in Hibernia gestis. Lib. IV." In this work we are told he took Giraldus Cambrensis for his guide, and he is said to have adopted freely the erroneous statements of that writer, though in some places he has corrected him from other writers. He published likewise "A Life of St. Patrick," and several Catholic works: of these, one was entitled "Brevis Præmonitio profutura Concertatione cum Jacobo Ufferio." This was occasioned by a work of Dr. Usher, afterwards the celebrated primate of Ireland, who was a nephew of Stanihurst: our author did not, however, live to finish the reply thus announced. Mr. Stanihurst tried his powers as a poet, by a version of the four first books of Virgil's Æneid in English hexameters. It is remarkable for the uncouthness of its diction and version. It is mentioned by Warton, who acknowledges that Mr. Stanihurst, with

with all his foolish pedantry, was certainly a scholar. He had a son, who became a Jesuit, and wrote various moral and religious works.

STANISLAUS I., LEZIN-SKI, king of Poland, born at Leopold in 1677, was son of a distinguished Polish noble, who, after occupying several important posts, was raised to that of grand treasurer of the crown. His son, the subject of this article, displayed at a very early period talents and dispositions which announced a character equally amiable and estimable. "His countenance," says his biographer, "expressed courage joined with sweetness, together with that air of openness and sincerity which is more persuasive than eloquence itself. He was brave, and enured to hardship and fatigue. He slept on a straw mattress, required scarcely any personal services from his domestics, was temperate, economical, adored by his vassals, and beloved by his friends." When Charles XII. of Sweden entered Poland, for the purpose of dethroning Augustus, Stanislaus, then palatine of Pomerania, was deputed to that prince from the confederation of Warfaw. In the conference with the monarch, he appeared to him in so favourable a light, that the Swede immediately took the resolution of raising him to the crown of Poland, which was effected at an election held July 12, 1704, when Stanislaus was in his twenty-seventh year. The unexpected entrance of Augustus into Warfaw, when the king of Sweden was at a distance with his army, obliged Stanislaus to make a precipitate retreat: but by another change he was brought back, and crowned at Warfaw with his wife, in October 1705, and by a treaty in the following year, Augustus was compelled solemnly to abdicate the crown of Poland in favour of his rival. Stanislaus remained possessor of the kingdom till the fatal defeat of his patron Charles, at Pultowa, in July 1709. Being now unable to maintain himself in Poland, he withdrew with the Swedes into Pomerania, and thence crossed into Sweden, where he passed some time in retirement, while negotiations were carrying on to restore the peace of the north. As his abdication of the Polish crown seemed a necessary preliminary, he readily signified his own concurrence, and wrote to Charles at Bender to obtain his consent. Not being able, by letter, to persuade him, he resolved to try the effect of a personal conference; and accordingly assumed a feigned name, and, accompanied by two officers, proceeded for the frontiers of Turkey. On his arrival in Moldavia he was arrested, and brought before Hospodar, who discovered his true person, and sent him to Bender, where he was detained as a prisoner, but was extremely well treated. He was suffered to depart in 1714, when he went to Deux Ponts, where he was joined by his family. A Saxon officer made an attempt to assassinate him, but the design was discovered before it could be put into execution, and he pardoned and dismissed the conspirators. In 1719 he received intelligence of the death of Charles XII., and feeling himself now deprived of his protector, he applied to the court of France, which gave him a retreat in Alsace. Here he lived in a state of great obscurity, until his daughter, the princess Mary, was unexpectedly chosen as queen to Lewis XV. This was in the year 1725, when Stanislaus removed to the castle of Chambord. On the death of Augustus in 1733, an attempt was made by the French monarch to replace Stanislaus on the Polish throne, and he repaired to Dantzic, in order to support the party which actually proclaimed him; but his competitor, the son of Augustus, and elector of Saxony, favoured by Austria and Russia, was more successful, and Stanislaus was obliged to quit Dantzic in disguise, and through many dangers escaped to Konigsberg. He supported this reverse of fortune with philosophical resign-

ation, and at the peace of 1736 he formally abdicated all claim and pretensions to the kingdom, on condition of retaining the title, and being put into possession for life of the duchies of Lorraine and Bar. Thenceforth he lived as the sovereign of a small country, which he rendered happy by the exercise of virtues, that caused him to be named by the general voice of his subjects, "Stanislaus the Beneficent." Instead of imposing new and oppressive taxes, he relieved his people from the pressure of many which they had heretofore borne; yet he was able, by a prudent economy, to found many useful and charitable establishments, and to patronize the arts and sciences. He was himself attached to literature, and wrote various treatises on moral, philosophical, and political topics, which were published under the title of "Œuvres du Philosophe Bienfaisant," 4 vols. 8vo. These volumes were published in 1765, and the royal author of them died in the following year, universally lamented.

STANISLAUS-AUGUSTUS, PONIATOWSKI, king of Poland, was the son of count Poniatowski, a Lithuanian, who, after being in the service of Charles XII. of Sweden, and of Augustus, king of Poland, married the princess Czartorinska, a descendant of the great family of the Jagellons. Stanislaus possessed a fine person, and a graceful demeanour, and was well received in the various parts of Europe which he visited while he was young. From England he accompanied the ambassador to Russia, where he acquired the particular favour of Catharine, then grand duchess. When she came to the crown, she exhibited her attachment by resolving to raise him to the throne of Poland on the death of Augustus III., and by means of a body of Russian troops, his election was carried in the plain of Vola, on the 7th day of September, 1764, when Stanislaus was in his thirty-second year. His talents and excellent disposition gave promise of a reign happy to himself and prosperous to his country; but the overbearing influence by which he had been elected, and the radical vices of the Polish constitution, acted as perpetual causes of tumult and dissention, and thwarted all the expectations and hopes that had been formed of the government of Stanislaus. The first disorders in this reign arose from religious differences. The non-catholics, comprised under the general name of Dissidents, had been constantly opposed in their claims of equal civil rights by the Romanists, and had been obliged to apply for protection to the Protestant powers and the court of Russia, who were guaranties of the treaty of Olivia, by which their privileges had been ratified. In 1766, at a diet, the ministers of these powers had presented memoirs in favour of the Dissidents, and the king seemed inclined to support their cause, while the Catholic prelates and nobles violently opposed them. The empress of Russia interfered effectually by sending troops into Poland, which advanced to the gates of Warfaw. Confederacies started up to resist them, and the country was plunged into civil war. The king was quite unable to quell these disorders, being regarded as having been imposed on the nation by a Russian force, and in 1771 an extraordinary attempt was made on his person, of which a very interesting account is given in the first volume of Coxe's Travels into Poland, which is thus concluded: "So extraordinary an escape is scarcely to be paralleled in history, and affords ample matter of wonder and surprise. Scarcely could the nobility or people at Warfaw credit the evidence of their senses, when they saw him return. Certainly neither the escape of the king of France from Damien, nor of the king of Portugal from the conspiracy of the duke d'Aveiro, were equally amazing or improbable as that of the king of Poland."

This attempt on the life of his majesty was planned by a Polish

Polish nobleman named Pulaski, who engaged three other chiefs by a solemn oath, either to place the king alive in his hands, or to kill him in case of resistance. These persons, at the head of forty dragoons, entered Warsaw in disguise, attacked and seized the king, and after having wounded him in the head with a sabre, dragged him through the streets, and carried him out of the city. After a while the conspirators were alarmed at what they had done, and they all, except one, took advantage of the darkness of night to make their escape, and at day-break the king found himself alone with a person named Kosiński, and both of them on foot. Taking advantage of the perplexity in which he saw this man was involved, the king represented to him in such colours the atrocity of the attempt, to which he added the promises of pardon and even reward, that he entirely gained him over, and they proceeded together to a mill. From thence the king wrote the following letter. "Par une espèce de miracle je suis sauvé des mains des assassins. Je suis ici au petit moulin de Mariemont. Venez au plutôt me tirer d'ici. Je suis blessé, mais pas fort." He was accordingly conducted back to Warsaw, and received amidst the joyful acclamations of the people.

Stanislaus, though retaining his crown, was unable to quiet or direct the distractions of the country: nor could he make any effectual opposition to that truly infamous partition of a large portion of Poland between the plunderers of Russia, Prussia, and Austria, which took place in 1773, and which may be regarded as the first act of those open violations of every principle of national justice, which have so peculiarly stigmatized the times in which we live. The same powers enforced alterations in the Polish constitution, calculated to perpetuate its weakness, and which were in vain opposed by Stanislaus and the best patriots of the country. In 1789 he had an interview with Catharine, who deluded him with hopes of advantages for the Poles, which, of course, were never realized: and in 1792, the armies of Russia and Prussia entered Poland, destroyed the constitution which had been formed by the people, and completed that division of its territories which expunged its name from the map of Europe. In 1795 Stanislaus was obliged, by order of the empress Catharine, to resign, and abdicate the crown which she had hitherto allowed him to wear, and he retired to Grodno, contented to live a pensioner on her bounty. On the accession of Paul, Stanislaus was treated with great respect. He died at Petersburg in 1798, beloved and esteemed for his qualities in private society.

STANISLAUS, *Order of St.*, was instituted by Stanislaus, king of Poland, in the year 1765. The badge of the order is a gold cross, enamelled red; on the centre a medalion; on this the image of St. Stanislaus, enamelled in proper colours; on the reverse, the letters SS in a cypher. It is worn scarfwise, pendent to a broad watered ribband, edged with white. The star of the order is silver, in the centre of which is a cypher of three letters, viz. S.A.R. signifying Stanislaus Augustus Rex; within, the following motto, *PRÆMIANDO INCITAT.*

STANISLAW, in *Geography*, a town of Austrian Poland, in Galicia; 66 miles S.S.E. of Lemberg.

STANITZ, a town of Bohemia, in the circle of Chrudim; 13 miles N. of Chrudim.—Also, a town of Moravia, in the circle of Brunn; 18 miles S.E. of Brunn.

STANK, is a dam made with pile-planks, or otherwise, to pen water.

STANKAU, in *Geography*, a town of Bohemia, in the circle of Pilsen; 9 miles N.N.E. of Pilsen.

STANLEY, THOMAS, in *Biography*, born at Cumberland-Green, in Hertfordshire, was the son of sir Thomas

Stanley, knight. He received his early education at home, under Edward Fairfax, the translator of Tasso's Jerusalem, and was admitted a gentleman-commoner of Pembroke-hall, Cambridge, in 1639. Having taken his degree of M.A. at that university, he went abroad, but returning during the civil war, he took up his residence in the Middle Temple. He there pursued his studies with much eagerness, and in 1651 published a volume of original poems, and a number of translations in verse from the ancient and modern languages. Turning his attention to graver topics, in 1655 he published the first volume of the work by which he is chiefly known, "The History of Philosophy; containing the Lives, Opinions, Actions, and Discourses of the Philosophers of every Sect." This was followed by three other volumes; they were afterwards republished in one volume folio; and in 1743, a quarto edition was given to the public. After the favourable reception which this work met with, the author published an edition of Æschylus, which was published in London in 1663, the text of which was copied into De Pauw's edition of 1745. He died in London, April 12, 1678, leaving behind him farther monuments of his industry and erudition, in manuscript, consisting of "Commentaries on Æschylus," in 8 vols. fol.: "Adversaria; or Remarks on Passages in various ancient Authors;" "Prelections on the Characters of Theophrastus;" and a Latin treatise on the first-fruits and tenths of the spoils mentioned in the Epistle to the Hebrews. He had been married to a Northamptonshire lady, co-heiress to a good estate, and he left a son, who published, at an early age, a translation of Ælian's "Various Histories."

STANLEY, JOHN, bachelor in music, was born in 1713. At two years old he totally lost his sight, by falling on a marble hearth with a china basin in his hand. At the age of seven he first began to learn music, as an art that was likely to amuse him, but without his friends supposing it possible for him, circumstanced as he was, to make it his profession. His first master was Reading, a scholar of Dr. Blow, and organist of Hackney. But his father finding that he not only received great pleasure from music, but had made a rapid progress, placed him with Dr. Greene, under whom he studied with great diligence, and a success that was astonishing. At eleven years of age he obtained the place of organist of All-hallows, Bread-street, and in 1726, at the age of thirteen, was elected organist of St. Andrew's, Holborn, in preference to a great number of candidates. In 1734, the benchers of the honourable society of the Inner Temple elected him one of their organists. These two places he retained till the time of his death. Few professors have spent a more active life in every branch of his art than this extraordinary musician; having been not only a most neat, pleasing, and accurate performer, but a natural and agreeable composer, and an intelligent instructor. He was the conductor and soul of the Swan and Castle concerts in the city, as long as they subsisted. Upon the death of Handel, he and Mr. Smith undertook to superintend the performance of oratorios during Lent; and after Mr. Smith retired, he carried them on, in conjunction with Mr. Linley, till within two years of his death, in 1786. This ingenious and worthy professor, whose blindness excited the pity, and performance the admiration, of the public for so many years, will be long lamented by his surviving friends; for they have lost in him, exclusive of his musical talents, a most intelligent and agreeable companion, who contributed to the pleasures of society as much by his conversation in private, as by his professional merit in public. He was succeeded in his office as master of the king's band, by Mr., afterwards sir William Parsons. See PARADIS, *Mademoiselle.*

STANLEY,

STANLEY, in *Geography*, a township in the parish of Wakefield, Yorkshire. See WAKEFIELD.

STANMORE, GREAT, a parish in the hundred of Gore, and county of Middlesex, England, is 10 miles N.W. from London. It comprises 1400 acres of land, the greater part of which is occupied as meadow and pasture, but about 250 acres still remain in common. From the number of Roman antiquities found within this parish, it is conjectured by Camden, Stukeley, and Reynolds, that the station called Sulloniacæ was at Brockley-hill. During the Anglo-Roman dynasty, this part of Middlesex, and a great part of Hertfordshire, were covered with woods: indeed, at the time of compiling the Domesday survey, it appears to have been chiefly forest. Fitz-Stevens, who wrote about 1170, says that an immense forest extends itself to the north of London, "and is full of the lairs and coverts of beasts and game." The village of Stanmore is of considerable extent, and consists chiefly of houses erected on the sides of the great road from London to St. Albans. There are some handsome mansions and villas within the parish; the chief of which is Stanmore-house, the elegant seat of the countess of Aylesford. The house is seated in an extensive park, distinguished for its varied surface and fine woods. A villa called the Grove, the residence of Charles Poole, esq. was possessed by Aaron Capadoce in 1802, who died here in that year, at the age of 105.

The present church of Stanmore was completed in 1632, at the sole expence of sir John Wolstenholme, knt. It is built of brick, and among other monuments is one by Nicholas Stone, commemorating the builder of the church. It contains a statue of the deceased, finely executed, and cost 200*l.* (See Walpole's *Anecdotes of Painting*.) In the parish of Stanmore-Parva is Canons, an ancient and celebrated seat of the Brydges family. This estate was rendered noted by James Brydges, duke of Chandos, who was paymaster of the forces to queen Anne, and who, having accumulated great wealth, resolved to build two magnificent houses, to surpass any of the ducal residences in England. One was commenced in Cavendish-square, London, but never finished; the other at Canons. Three architects were employed, Gibbs, James, and Shepherd; and Vertue describes the house as "a noble square pile, all of stone;" ornamented with statues, busts, paintings, &c. Italian artists were employed to stucco and paint the walls and ceilings, and a profusion of marble was used in pillars, floors, &c. In the erection and decoration of this noble mansion, and in planting the ground, it is related that not less than 250,000*l.* were expended. Corresponding with the building were the domestic establishment and style of living within the house: all was grandeur and ostentation. The duke dined in public, and was attended by a band of music and a military guard. This parade excited the envy and satirical animadversions of Pope and some other poets. In Pope's satire on False Taste, the character of Timon is supposed to be intended for the duke. The splendid mansion just mentioned was taken down, and the materials sold by auction, in 1747; and a small but neat villa was afterwards built by Mr. Hallet, and which is now the property and residence of sir Thomas Plumer. *Beauties of England*, vol. x. pt. 4. Middlesex. By J. N. Brewer, 1816.

STANNARIES, STANNARIA, the mines and works where tin is dug and purified: as in Cornwall, Devonshire, &c. There are four courts of the stannaries in Devonshire, and as many in Cornwall, for the administration of justice among the tinners. See *Stannary-Courts*.

STANNEL, in *Ornithology*, an English name of a species of hawk, more commonly known by the names of the

kestrel, or the *windhover*; and called by Latin authors *tinnunculus* and *cenchris*.

STANNER-WORT, in *Agriculture*, the common name of a troublesome weed in arable as well as grafs-lands. See RAG-WORT.

STANNUM, TIN. See TIN.

STANOVAIA, in *Geography*, a fortress of Russia, in the government of Tobolsk; 8 miles S.W. of Ischim.

STANOVITZKOI, a town of Russia, in the government of Novgorod; 48 miles N.W. of Tcherapovetz.

STANSTEAD, a township of Lower Canada, bounded W. by lake Memphramagog, and S. by Vermont: settled by about 750 inhabitants, a promiscuous emigration from various parts of the United States.

STANSTED, a town of Virginia; 5 miles N. of Fal-mouth.

STANTONS, a town of North Carolina; 8 miles W. of Guildford.

STANTZ, a town of Switzerland, in the canton of Unterwalden, of which it was formerly the capital, on the lake of Lucerne; 8 miles S.E. of Lucerne. N. lat. 46° 51'. E. long. 8° 10'.—Also, a river of Stiria, which runs into the Muehr, 20 miles E.S.E. of Luttenberg.

STANZA, in *Poetry*, a certain stated number of grave verses, containing some perfect sense, terminated with a rest or pause.

The word is Italian, and literally signifies a stand or station, because of the pause to be made at the end of each stanza, or complete sense.

What the *couplet* is in songs, and the *strophe* in odes, the *stanza* is in the great and graver pieces, as epic poems, &c. Indeed, the Italians scarcely write any poems but they divide them into stanzas. There are stanzas of four, six, eight, ten, twelve, and fourteen verses, and sometimes of an uneven number of verses, as five, seven, &c. But these last are somewhat more difficult to execute, by reason of the three verses to one rhyme. The French lay it down as a rule, that if the first stanza begin with a masculine or feminine verse, the second is to begin and end with the same.

Every stanza ought not only to contain a perfect sense, but to be terminated with some lively and ingenious thought, or some just and pertinent reflection.

Stanzas were first introduced from the Italian into the French poetry about the year 1580, and thence they were transferred into the English.

The use of stanzas in tragedy, or comedy, is condemned by all the best critics; for though we speak verse on the stage, it is still presumed we are speaking prose. Stanzas shew a degree of ingenuity on the part of the poet, which has nothing of nature in it on the part of the actor. Add to this, that stanzas are not fit to express every thing: wrath, threatening, &c. fit very ill on a regular stanza; though irresolution, reveries, and every thing that leads the actor to think on what he is to resolve, agree well enough with the unequal cadence of the stanza.

STANZIONE, CAVALIERE MASSIMO, in *Biography*, was born at Naples in 1585, and was a disciple of G. B. Caracciolo: he also received instructions in fresco painting from Belisario Coferzio, one of the most eminent artists of his time, and indeed seems to have been exceedingly studious of the works of all the great painters of his day. He visited Rome, and in studying the works of Annibal Caracci, became intimate with Guido Rheni, into whose style he fell with so much success, that he obtained the name of *Il Guido Rheni di Napoli*.

It was in his native city that he principally exerted his ability in original productions, and was ranked among its ablest

ablest artists. Spagnoletto became jealous of him, and is said by Lanzi to have been guilty of a gross piece of perfidy to destroy the picture he had painted in competition with his Descend from the Cross, for the Certosa. The subject of his picture was Christ with the Maries, which having somewhat changed in tone, and become darker, Spagnoletto persuaded the monks to permit him to clean it; when he used some noxious preparation, which nearly destroyed the work. Upon application to Stanzione to remedy the mischief, he refused, declaring it should remain as it was, that the author of so disgraceful a procedure might reap the just fruits of his perfidy.

Among the considerable works executed by Stanzione at Naples, are the ceilings of the churches of St. Paolo and del Gesu Novo, and a large picture at the Certosa, representing St. Bruno presenting the regulations of his order to his monks. The small cabinet pictures by him are numerous, and much esteemed. He died at the age of 71, in the year 1656.

STAPEDIUS, or STAPIDÆUS, or *Stapidis Musculus*, in *Anatomy*, the smallest muscle in the body, situated in the tympanum of the ear. See EAR.

STAPELBURG, in *Geography*, a town of Germany, in the county of Wernigerode; 6 miles W. of Wernigerode.

STAPELIA, in *Botany*, an extensive and very singular genus of African plants, so named by Linnæus, in honour of Dr. John Bodæus a Stapel, the laborious and learned Dutch editor of Theophrastus. His edition of this ancient author, published in folio at Amsterdam, in 1644, is the best which has appeared.—Linn. Gen. 121. Schreb. 169. Willd. Sp. Pl. v. 1. 1277. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 2. 84. Brown Tr. of the Wernerian Society, v. 1. 23. Juss. 146. Lamarck Illustr. t. 178.—Class and order, *Pentandria Digynia*. Nat. Ord. *Contortæ*, Linn. *Apocineæ*, Juss. *Asclepiadææ*, Brown.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, small, in five acute segments, permanent. *Cor.* of one petal, large, thick, divided more than half way into five broad, flat, pointed segments, sometimes with intermediate teeth. Nectary (or Crown of the stamens) double; the outer in five segments or leaves, various in different species; inner of five leaves, alternate with the outer, undivided, sometimes obsolete; all much shorter than the petal. *Stam.* Filaments five, flat, short, more or less connected; anthers simple at the point; "masses of pollen attached by their base, cartilaginous and pellucid at one margin." *Br.* *Pist.* Germens two, ovate, flat on the inner side; styles none; common stigma pointless. *Peric.* Follicles two, nearly cylindrical, smooth, taper-pointed. *Seeds* numerous, imbricated, compressed, crowned with fine hairs.

Ess. Ch. Corolla of one petal, five-cleft. Nectary a double star, covering the organs of impregnation. Common stigma pointless. Follicles two, smooth. Seeds comose.

Such is the Linnæan genus of *Stapelia*, preserved entire by the late Mr. Dryander, in Ait. Hort. Kew., though Mr. Brown has separated some genera from it. (See HUERNIA and PIARANTHUS.) We have already, under those articles, ventured to express an opinion that the original genus, on account of its very distinct habit, and the varieties of structure in its nectary or crown, might best remain undisturbed. We shall therefore consider it under that point of view, giving examples of its various sections. Linnæus has, even in the fourteenth edition of Syst. Veg., but five *Stapeliæ*; Willdenow has forty-nine, mostly adopted from Mr. Masson's rich and splendid illustration of this genus, published

in 1796, with forty-one coloured folio plates. As this able collector sent most of his discoveries to Kew, forty-four species appear in Mr. Aiton's work. They are all natives of the deserts of Southern Africa, except three found by Forskall in Arabia Felix, and one by Roxburgh in India. Their habit is extremely succulent, toothed, angular, and gibbous, without leaves. *Flowers* lateral, stalked, various in size, parti-coloured, generally of a dark and speckled hue, often remarkable for an extraordinary fetor, resembling carrion, rotten cheese, corrupted water, or such delectable odours, and grateful perhaps to the Hottentots, to whose country these flowers belong. The *Stapeliæ* are easily cultivated in pots, in a dry stove, with very sparing supplies of water, and as much sun as our skies will afford. They blossom pretty freely, at various seasons, and if their odour can be tolerated, their beauty will amply repay the moderate care they require.

Section 1. *Corolla simple, five-cleft, its edges hairy*. Twenty species.

S. ciliata. Fringed Buff Stapelia. Willd. n. 1. Ait. n. 1. Masson Stap. 9. t. 1. Thunb. Prodr. 46.—Stem procumbent. Teeth of the branches spreading. Surface of the corolla papillary; its margin fringed; segments ovate, acute.—Native of very dry situations at the Cape of Good Hope, below the hill called *Bockland Berg*. It flowers in our gardens from October to December. The stem is branched, procumbent, taking root here and there, with short, erect branches, stained with brown, intermixed with a less glaucous green than in most other species; its length about a foot. The teeth of the branches are unusually large and spreading, somewhat unequal and irregular. *Flowers* solitary, near three inches wide, buff-coloured; violet in the centre. Hairs of their fringe minutely club-shaped.

S. hirsuta. Hairy Stapelia, or Carrion Flower. Linn. Sp. Pl. 316. Willd. n. 3. Ait. n. 3. Jacq. Misc. v. 1. 28. t. 3. (*Asclepias africana aizoides*, flore pulchre fimbriato; Commel. Rar. 19. t. 19.)—Branches ascending, quadrangular, with erect teeth; flowering at the base. Corolla hairy at the margin and centre; segments ovate, acute, transversely corrugated.—Native of the Cape. Introduced very early from thence, by the Dutch, into the gardens of Europe, where it has ever since been preserved. The flower is large and handsome, of a dark chocolate crimson, streaked across with yellow; the marginal fringe resembling grey fur. Its scent is so like carrion, that flesh-flies lay their eggs upon it, and the maggots are starved for want of their proper food. Sir John Hill asserted, in an express dissertation, that these flies are a peculiar species, whose maggots feed on the flower. For which falsehood he is stigmatized by the great entomologist Fabricius, as "*damnandæ memoriæ Johannes Hill*."

S. fororia, Masson, t. 39; *grandiflora*, t. 11; *ambigua*, t. 12; and *Asterias*, t. 14; are nearly related to *hirsuta*, in the size and general aspect of their flowers, but all sufficiently distinct.

S. pulvinata. Cushion-flowered Stapelia. Masson Stap. 13. t. 13. Willd. n. 7. Ait. n. 6. Curt. Mag. t. 1240.—Stem procumbent. Branches quadrangular, with erect teeth; flowering at the base. Corolla hairy at the margin; its rounded segments shorter than the diameter of the tumid shaggy centre.—Native of the Cape, in bushy places at *Camies berg*. Masson. The Dutch inhabitants call this species the Arabian Rose, notwithstanding its fetor. For size and beauty it is indeed conspicuous, and though akin to *hirsuta*, and to the other species we have just named, is distinguished by the very tumid, shaggy, cushion-like centre of the flower, and the short, rounded segments of the limb, each

each tipped with a sharp point, of a different colour from its disk.

S. divaricata. Straddling Stapelia. Maffon Stap. 17. t. 22. Willd. n. 10. Ait. n. 9. Curt. Mag. t. 1007.—Branches bluntly quadrangular, tapering, spreading. Corolla very even; its segments lanceolate, pointed; revolute and distantly fringed at the margin.—Sent by Mr. Maffon, from the Cape, in 1793. The habit is slender, lax, and spreading. Flowers smaller than any of the foregoing, being but two inches wide, of a deep flesh-colour, polished, peculiarly smooth; their segments narrow, and so much reflexed, that the hairs on their edges may easily escape notice.

S. parviflora. Small-flowered Stapelia. Maffon Stap. 22. t. 35. Willd. n. 17. Ait. n. 16.—Branches acutely quadrangular, with recurved teeth; flowering in the upper part. Segments of the corolla lanceolate, fringed, shorter than the flower-stalk.—Native of bushy parts of Namaqua land. The branched stems are erect and stout, bright green, with large, compressed, hooked teeth. Flowers not half an inch broad, yellow, hairy, on deflexed purple stalks, scarcely an inch in length.

S. glanduliflora. Glandular-flowered Stapelia. Maffon Stap. 16. t. 19. Ait. n. 18. Sm. Exot. Bot. v. 2. 23. t. 71. (*S. glandulifera*; Willd. n. 20.)—Branches quadrangular, with upright teeth. Segments of the corolla ovate, acute, covered with club-shaped glands, and shorter than the flower-stalk.—Found in the deserts about *Nord Olifant's* river, by Mr. Maffon, who sent it to Kew in 1795. It flowers there late in autumn. The stems are green, erect, somewhat downy at the edges. Flowers above an inch broad, tawny or yellowish, clothed with erect club-shaped glands, of a very singular appearance. Crown of the stamens orange and black.

Section 2. *Corolla simply five-cleft, smooth-edged*. Twenty-two species, to which some are added in Hort. Kew. and Curt. Mag.

S. pedunculata. Long-stalked Stapelia. Maffon Stap. 17. t. 21. Willd. n. 21. Ait. n. 19. Curt. Mag. t. 793.—Branches bluntly angular, toothed at the top. Segments of the corolla lanceolate, acute, with tufts of pendulous glands at the base. Flower-stalks twice as long as the branches.—Native of dry places at *Camies berg*. Maffon. The branches are glaucous, tumid, with blunt, often obliterated angles, rather notched than toothed, except at the end. Flower-stalks five or six inches long. Flowers an inch and half, or two inches, wide, with narrow convex segments, of a more or less deep or variegated brown, accompanied at the base by pendulous tufts of trembling black glands. The centre of the flower is also black.

S. Gordoni. Gordon's Stapelia. Maffon Stap. 24. t. 40. Willd. n. 23.—Corolla orbicular, very slightly five-cleft. Stem branched, round, with copious spinous tubercles.—Gathered in *Groot Namaqua Land*, near Orange river, by Mr. Gordon, from whom Mr. Maffon received a drawing of this very singular species, it being the only one of the genus he had not himself seen and examined. The stem is represented erect, branched, a foot high, green, very thick and obtuse, beset all over with blunt tubercles, each bearing a prominent thorn. Flowers above two inches wide, of a pale nearly even brown, very smooth, convex, with five very shallow acute lobes, and a little blackish crown in the middle. The stalk is hardly an inch long.

S. pilifera. Hairy-tubercled Stapelia. Linn. Suppl. 171. Willd. n. 24. Ait. n. 21. Maffon Stap. 17. t. 23.—Branches erect, round, tumid, with copious tubercles, each

tipped with a bristle. Segments of the corolla ovate, pointed, smooth. Flowers sessile, scattered.—Native of very dry hills, in the deserts at the Cape of Good Hope. The Hottentots are said to eat it, knowing it by the name of *Guaap*. The habit of the plant is very like the last, only the tubercles are smaller in proportion, and bear bristles instead of thorns. The flowers are small, half an inch broad, smooth, of a dark purplish-brown, with a black and yellow crown, surrounded by a red circle. This species confirms the genus of the last, if there could be any doubt on that subject.

S. articulata. Jointed Stapelia. Maffon Stap. 20. t. 30. Willd. n. 26. Ait. n. 22.—Branches spreading, round, tessellated with pointed tubercles. Flowers nearly sessile; their segments triangular, papillary.—Native of the country of *Roggeveldt*, at the Cape of Good Hope. The Hottentots eat it raw; the Dutch settlers pickle it with vinegar. This is of a glaucous, often reddish, hue, and singularly tessellated, growing in a proliferous straggling form; its structure akin to the two last. Flowers very small; their parts not clearly intelligible from Maffon's figure, nor have we seen a recent specimen. They are scattered about the toothed summits of the branches.

S. mammillaris. Prickly Stapelia. Linn. Mant. 2. 216. Willd. n. 27. Ait. n. 23. (*S. aphyllus*, ad nodos mammillaris, stiloculo rubello, siliquis pendulis; Burm. Afric. 27. t. 11.)—Branches erect, roundish, with copious spinous tubercles. Flowers stalked; their segments lanceolate, smooth.—Native of the Cape, from whence it was sent to Kew, by Mr. Maffon, and having flowered there, proves very distinct from the last, to which he suspects, in his work, it might belong. The tubercles are prominent, and their spines very stout, even more so than in *S. Gordoni*, which this species nearly equals in stature. The flowers however are much smaller, and totally different in the form of their segments.

S. pulla. Black-flowered Stapelia. Maffon Stap. 21. t. 31. Willd. n. 30. Ait. n. 26.—Branches imperfectly hexagonal, erect, with spreading spinous teeth. Segments of the corolla lanceolate, revolute, smooth.—Native of the hot sandy deserts called *Karròs*, at the Cape of Good Hope. Brought to Kew by Mr. Maffon, in 1774. This is somewhat related to the last, being, though less tuberculated, and more angular, furnished with similar spines. The flowers also seem similarly formed. They grow, several together, on short aggregate stalks, and are pale externally, but almost black on the upper surface of their narrow, taper, almost erect, segments.

S. adscendens. East Indian Stapelia. Roxb. Corom. v. 1. 28. t. 30. Willd. n. 31. (*Caralluma*; Brown Tr. of the Wern. Soc. v. 1. 25.)—Branches quadrangular, ascending, toothed, flowering about the summit. Segments of the corolla ovato-lanceolate, pointed, revolute, smooth.—Found among bushes, on high dry barren ground in the East Indies, flowering in the wet season. The Telingas, according to Dr. Roxburgh, call it *Car-allum*, and eat the young tender branches raw, though they are bitter and salt to the taste. The stems are perennial, slender, a foot or two high, branched, their angles beset with ascending teeth. Flowers near an inch in diameter, scattered, on short stalks, towards the ends of the branches. Segments of the corolla green in the lower half; dark purple in the other part; pale beneath. We can form no idea of the structure of the crown, or neighbouring parts, from the figure, nor has Dr. Roxburgh ventured to explain them. Mr. Brown describes the crown as of ten leaflets, in a simple series;

five of them opposite to the anthers, and undivided; the last deeply divided, awl-shaped. With much respect for his opinion, we think the plant ought not to be separated from *Stapelia*, and therefore we need say nothing of his generic name.

S. incarnata. Flesh-coloured *Stapelia*. Linn. Suppl. 171. Willd. n. 33. Ait. n. 27. Masson Stap. 22. t. 34. (*Euphorbium erectum*, quadrangulare, spinolum, ramis lateralibus rotundis foliosis; Burm. Afric. 15. t. 7. f. 1.)—Branches quadrangular, erect, toothed, flowering about the summit. Segments of the corolla lanceolate, flat, pointless, smooth.—Found by Thunberg and Masson, in dry sandy fields at the Cape. About a foot high, glaucous, much flouter than the last. *Flowers* numerous, nearly sessile, scattered about the upper part of each branch, each half an inch broad, pale pink or white. The Hottentots are said to eat the branches.

S. punctata. Purple-dotted *Stapelia*. Masson Stap. 18. t. 24. Willd. n. 34. Ait. n. 28.—Stem proliferous, decumbent, with oblong, somewhat quadrangular, toothed joints. Corolla bell-shaped, with lanceolate acute segments; papillary on the upper surface.—Native of the *Namaqua lands*, in Southern Africa. Sent to Kew in 1795, where it flowers most part of the autumn. This is one of a tribe, of which Mr. Masson has described several more species, whose stems are composed of oblong or elliptical, proliferous joints, or branches, and whose flowers, supported by longish stalks, have lanceolate acute segments, dotted or glandular all over their upper surface. In the present instance the corolla, about an inch in diameter, has a bell-shaped tube, externally of a blueish-white. The upper side is pink, with purple dots. The flower-stalks, near two inches long, grow three or four together, and are of the same pink hue as the corolla.

S. geminata, Masson t. 25, and *decora*, t. 26, are, in habit and general character, allied to the last.

S. picta. Painted *Stapelia*. Sims in Curt. Mag. t. 1169. Ait. n. 34. (*S. variegata*; Jacq. Misc. v. 1. 27. t. 4.)—Branches simple, ascending, quadrangular, with spreading teeth. Segments of the corolla ovate, pointed, corrugated; the annular centre very rugged. Five leaflets of the crown cloven.—Native of the Cape of Good Hope, from whence Messrs. Loddiges are said to have introduced it into the English collections. The structure of the nectary however induces us to believe, with Dr. Sims, it is what Jacquin has figured as *S. variegata* of Linnæus, hereafter mentioned. This belongs, with the real *variegata*, to no less distinct a tribe of species than the last. Their stems, composed of numerous simple erect branches, have a tufted habit; their colour is less glaucous than in most others; the teeth of their branches are numerous, and strongly marked, spreading in four rows. *Flowers* about two inches wide, on deflexed solitary stalks, yellow, either transversely streaked or dotted with a chocolate-brown; their segments broad, rugged or warty. Crown of the flammens various in the different species. The colouring of the present flower is darker, and more blotched, than usual.

S. verrucosa. Warty-flowered *Stapelia*. Masson Stap. 11. t. 8. Willd. n. 39. Ait. n. 35. Curt. Mag. t. 786?—Branches simple, ascending, bluntly quadrangular, with spreading teeth. Segments of the corolla ovate, pointed, warty; the centre concave, with a rough pentagonal elevation.—Found in dry ground at the Cape. Akin to the last, but the corolla is warty, or tuberculated, not transversely corrugated. We cannot but have some doubts concerning the synonym of the Botanical Magazine, as the

representation there of the crown of the flower is not reconcilable to Mr. Masson's figure. One or the other must be incorrect. In the branches we see no important difference.

S. irrorata, Masson t. 9, is one of the same tribe, and perhaps nearer the plant of the Botanical Magazine.

S. variegata. Variegated *Stapelia*. Linn. Sp. Pl. 316. Willd. n. 42. Ait. n. 37. Curt. Mag. t. 26. (*Fritillaria crassa*, promontorii Bonæ Spei; Stapel. Theophr. 335.)—Stem branched upwards, quadrangular, with spreading teeth. Segments of the corolla ovate, pointed, corrugated; the annular centre concave, rugged. Leaflets of the crown all undivided.—Native of the Cape, from whence it was early brought to Europe. This is most akin to *S. picta*; but if the observations of our friend Dr. Sims be, as usual, correct, the leaflets of the crown, or nectary, being all undivided in the true *variegata*, essentially distinguish it. This flower smells like rotten cheese. It is prettily spotted with brown on a yellow ground. We dare not rely on all the old synonyms, the crown not being accurately expressed; especially as there are several species, so easily to be confounded with the present, which may have been cultivated, without being well distinguished.

S. busonis, Curt. Mag. t. 1676, is one of these uncertain species, nearly akin to the *picta*. They require to be all compared in a living state, particularly with regard to the structure of the crown.

Section 3. *Corolla with five intermediate teeth*. Six species, to which one is added in Hort. Kew. This section comprehends Mr. Brown's genus HUERNIA. See that article.

S. campanulata. Bell-shaped *Stapelia*. Masson Stap. 11. t. 6. Willd. n. 43. Ait. n. 38. Curt. Mag. t. 1227, and t. 1661!—Corolla bell-shaped, with ten teeth, rough; its tube internally bearded. Branches with four compressed toothed angles.—Native of dry ground at the Cape, from whence several collectors have received living plants. The branches are thick, ascending, somewhat tufted, with four, or more, very prominent, compressed angles, beset with large, acute, compressed, projecting teeth. *Flowers* two inches wide, with a perfectly bell-shaped tube, which is lined, and almost filled up, with converging, glandular, purple hairs; limb in five pointed shallow lobes, with as many very small intermediate ones, its inner surface cream-coloured or buff, dotted with purple. We cannot account for this species being given a second time in the Botanical Magazine without any reference to the former figure, which best agrees with Mr. Masson's, and with the specimens we have seen.

S. reticulata. Netted *Stapelia*. Masson Stap. 9. t. 2. Willd. n. 48. Ait. n. 43. Curt. Mag. t. 1662.—Corolla with ten teeth; its tube internally bearded, and surrounded with a tumid ring. Branches with five compressed angles, beset with hooked teeth.—Found in hollows of rocks, near north *Olifant's* river, at the Cape. The numerous, rather hooked teeth of the branches, differ somewhat from the last. Masson's figure of the flower is more striking, and more faithful, than that of the Magazine. The corolla, beautifully variegated with crimson and dark purple, is marked with a kind of net-work. The ring round its mouth, or tube, is singularly tumid; the latter is filled with purple hairs, as in *S. campanulata*.

S. lentiginosa. Freckled *Stapelia*. Sims in Curt. Mag. t. 506. Ait. n. 44.—Corolla with ten teeth; its tube bell-shaped, naked, surrounded with a tumid ring. Stem branched in the upper part, five-angled, with hooked teeth.

Brought

Brought by Mr. Masson from the Cape to Kew in 1795, though it does not occur in his work. The flower most agrees with his *guttata*, but the habit of the plant is very different.

Section 4: *Flowers not yet observed.* One species. Willdenow.

S. clavata. Club-shaped Stapelia. Willd. n. 49.—“Stem simple, thick, club-shaped, reticulated with obscure warts, flowering at the summit.”—Gathered by governor Patterfon, in sandy fields beyond *Kopperberg*, at the Cape. He has delineated the fruit only in his travels, tab. 8, according to the German edition, cited by Willdenow.

We beg leave to observe that the two first sections of the present genus are entirely artificial, the fringe of the *corolla* not leading to any natural affinities of species.

STAPELIA, in *Gardening*, contains plants of the succulent perennial kind, of which the species cultivated are, the hairy stapelia (*S. hirsuta*); and the variegated stapelia (*S. variegata*).

Method of Culture.—These sorts of plants are readily increased by cuttings or slips of the young branches, which should be exposed a few days in a dry covered place to heal over the cut part, and be then planted in pots, filled with light, poor, dry, fresh, sandy earth, with lime rubbish, plunging them in the tan-bed of the stove, where they soon strike root. When they are well rooted, they may be removed into separate pots, replunging them in the bed till fresh rooted, when they may be placed on the tops of the flues, or on the shelves in the hot-house. They are also capable of being preserved in the greenhouse. They have a fine effect in their leaflets, protuberant, warted appearance, and the beauty of their flowers, which are large, stellated, variegated, spotted, and differently striped.

STAPES, in *Anatomy*, one of the small bones of the ear, exactly resembling in shape the iron part of a stirrup. See EAR and CRANIUM.

STAPHISAGRIA, in *Botany and Gardening*. See DELPHINIUM.

STAPHISAGRIA, in the *Materia Medica*. See STAVES-ACRE.

STAPHYLÆA, in *Botany*, abridged by Linnæus from *Staphylodendrum* of Tournefort and of ancient authors, derived from *σταχυλῆ*, a bunch, or cluster, and *δένδρον*, a tree, because the clustered fruit of this shrub resembles a bunch of grapes in its mode of growth.—Linn. Gen. 148. Schreb. 198. Willd. Sp. Pl. v. 1. 1497. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 377. Prodr. Fl. Græc. Sibth. v. 1. 208. Ait. Hort. Kew. v. 2. 171. Pursh v. 1. 129. Jusl. 377. Tournef. t. 386. Lamarek Dict. v. 7. 391. Illultr. t. 210. Gært. t. 69.—Class and order, *Pentandria Trigynia*. Nat. Ord. *Tribilata*, Linn. *Rhamnii*, Jul. 1.

Gen. Ch. Cal. Perianth inferior, of one leaf, five-cleft, concave, roundish, coloured, the size of the corolla. Cor. Petals five, oblong, erect, like the segments of the calyx. Nectary at the receptacle of the fructification, in the base of the flower, concave, urn-shaped. Stam. Filaments five, oblong, erect, the length of the calyx; anthers simple. Pist. Germen superior, thickish, three-cleft; styles three, simple, a little longer than the stamens; stigmas obtuse, contiguous. Peric. Capsules three, inflated, flaccid, united longitudinally by a suture, pointed at the tip, bursting inwardly. Seeds two, bony, globular, with an oblique point, and an orbicular excavation at the side of the orifice.

Obs. In *S. pinnata* the germen, instead of being three-cleft, is mostly bifid, and there are generally but two capsules.

Ess. Ch. Calyx inferior, in five segments. Petals five.

Capsules inflated, joined together. Seeds two, globose, with a scar on one side.

1. *S. occidentalis.* Jamaica Bladder-nut. Willd. n. 1. Swartz Ind. Occ. v. 1. 566. (*Arbor jamaicensis fraxini alatis foliis, floribus pentapetalis corymbosis*; Pluk. Alm. 45. t. 269. f. 1.)—Leaves doubly pinnate. Capsules triangular. Seeds solitary. Stem arboreous.—Native of fields in the mountainous parts of Jamaica, flowering in the spring and autumn. A tree from twenty to thirty feet in height, with a smooth trunk, and round, smoothish, shining branches. Leaves alternate, stalked; leaflets two or three pair, ovate, pointed, serrated, smooth, shining. Stipulas two, between each pair of leaflets, small, incurved. Flowers in terminal, erect, lax clusters, white, fragrant, three on each stalk. Capsules scarcely inflated.

2. *S. pinnata.* Bladder-nut Tree. Linn. Sp. Pl. 386. Engl. Bot. t. 1560. “Schmidt. Arb. t. 80.”—Leaves pinnate. Styles and capsules but two.—Native of the south of Europe; but of such rare occurrence in this country as to be scarcely deemed indigenous, although it is admitted into the British Flora. It blossoms in May or June, and perfects fruit rather late in the autumn. Stem shrubby, five or six feet high, branched, smooth. Leaves unequally pinnate; leaflets five, opposite, ovate, serrated, acute. Stipulas large, membranous, brownish. Flowers in terminal, compound, drooping clusters, bell-shaped, pale yellow. Bractæas setaceous, membranous. Capsules two, rarely three, membranous, inflated, each containing two large, globular seeds, which when ripe are hard, light brown, and look as if varnished.

The general appearance of this shrub somewhat resembles that of the common Ash.

3. *S. trifolia.* Three-leaved Bladder-nut. Linn. Sp. Pl. 386. “Schmidt. Arb. t. 81.”—Leaves ternate.—Native of dry hills, in rocky situations from New York to Upper Carolina, flowering in May and June. Pursh. Stem stouter than in the last species; the older branches grey; the younger green, smooth. Leaves three together, ovate, pointed, serrated, the terminal one largest. Flowers produced from the sides of the branches, in longer clusters, but on shorter stalks, of a clearer white, and somewhat larger than in the last.

STAPHYLÆA, in *Gardening*, contains plants of the hardy, deciduous, flowering, shrubby kind, of which the species cultivated are, the five-leaved bladder-nut (*S. pinnata*); and the three-leaved bladder-nut (*S. trifolia*).

Method of Culture.—These plants may be increased by seeds, suckers, layers, and cuttings. The seeds should be sown as soon as they become ripe, in the autumn, in a bed of common earth, to the depth of an inch: they should be kept clear from weeds, and refreshed in dry weather with water frequently. In the following autumn or spring, the large plants should be removed into nursery-rows, at two feet apart, and one foot distant in the rows, to remain till of sufficient growth for the shrubbery. The suckers may be separated and taken up in autumn, or early in the spring, with root-fibres to them, and planted in nursery lines in the above manner. The layers may be put down from the young branches, being either slit or twisted; and, when properly rooted in the following autumn, be planted out in the nursery as above. The cuttings should be made from the lower parts of the young shoots of the preceding year, planting them in a shady border in the autumn, and watering them frequently during the spring and summer, when the weather is dry; and when well rooted, in the autumn following, planting them out in the nursery-rows as above, or where they are to remain. They afford ornament and

variety in the shrubby parts of pleasure-grounds, as well as in some other parts, by their long pendulous bunches of flowers, and bladder-shaped capsules, which have a singular appearance and effect in the autumnal season.

STAPHYLE, a word used by the old Greek writers, sometimes to express a grape, and sometimes a disorder of the uvula, which consists in an extenuation of its superior part, and a tumour of the inferior, whence it hangs down in the shape of a grape. The uvula, or gargareon, is also thus called by some writers.

STAPHYLEPARTES, the name of a surgical instrument, in use among the ancients for elevating the uvula. It is mentioned by Paulus Ægineta.

STAPHYLINUS, in *Anatomy*, the muscle of the uvula, commonly called *azygus*. See **DEGLUTITION**.

STAPHYLINUS, in *Botany*, a name given by some authors to the common *daucus sylvestris*, wild carrot, or bird's nest.

STAPHYLINUS, in *Entomology*, a genus of insects of the order *Coleoptera*. The generic character is as follows: Antennæ moniliform; four feelers; shell half as long as the body; wings folded up under the shells; tail not armed with a forceps, furnished with two exsertile vesicles. The insects of this genus are extremely rapacious, devouring not only the insects of other genera, but frequently each other. Many of them, when attempted to be caught, turn up the tail. The jaws are strong and exerted, with which they bite and pinch very hard: most of them are found in damp moist places, among substances, and a few upon flowers. There are about 180 species, separated into three sections, according as their feelers are filiform, hatchet-shaped, or clavate. Of these we shall notice but very few that are not to be found in this country.

Species.

A. *All the Feelers filiform.*

AUREUS. Head, thorax, and shells, covered with ferruginous down; the abdomen is black, with cinereous bands. It is found in Siam.

* **HIRTUS**. Hairy, black; thorax and hind-part of the abdomen yellow. Found in sandy situations, in this country, and other parts of Europe.

* **MURINUS**. Pubescent, cinereous, clouded; abdomen and legs deep black. It is found in this country, among decayed carcases and dung. The shells are blue, and polished beneath. The larva is six-footed, naked, and of a pale hue. The head and three first segments of the abdomen chestnut-brown; tail with two jointed bristles, and a cylindrical tubercle beneath.

* **OLENS**. Black, opaque, immaculate; head broader than the thorax. This is an English insect, but found likewise in many parts of the European continent.

* **MAXILLOSUS**. Pubescent, black, with cinereous bands. The jaws of this insect are as long as the head; the antennæ are still longer; the shell covers one third of the abdomen; the legs end in small tufts of hair.

* **ERYTHROPTERUS**. Black; shells, base of the antennæ, and legs, are red; the head and thorax are unpolished, black; shells with two triangular spots; each side is composed of a few gilded hairs.

* **POLITUS**. Black; thorax and shells polished; thorax with a line of impressed dots. This insect, when first caught, scatters a very fragrant odour.

* **BRUNNIPES**. Black; legs, base and tip of the antennæ, ferruginous; the antennæ are black, the first and two last joints are ferruginous; the eyes are white.

MARGINATUS. Black; sides of the thorax and legs are

yellow. It is something less than the *S. politus*, and of a glossy-black.

ALPINUS. Black; base of the antennæ, shells, and legs, livid. It inhabits the highest mountains of Lapland, on the birch. The body of this species is more depressed than is the case with regard to others; the antennæ are black, and pale at the base; the abdomen is black.

* **BI-PUSTULATUS**. Black; shells with a ferruginous dot behind.

BI-GUTTATUS. Black; shells with a whitish dot; the eyes are prominent. It inhabits the shores of the Baltic.

* **FUSCIPES**. Black; thorax roundish; shells and legs piceous; the body is small and thick; the edges a little blackish.

* **ATRICAPILLUS**. Thorax rufous; shells brown, with a white dot and hinder margin.

SANGUINEUS. Gibbous, black; shells sanguineous; antennæ thicker towards the top. This is found chiefly in France. The antennæ are as long as the body; the head is rough; the shells are striate at the base; legs yellowish; thighs brown; body sometimes chestnut-brown.

* **CARABOIDES**. Yellow, immaculate.

* **RUGOSUS**. Black; thorax and shells rugged. It is larger than the next. The head is flat; the thorax depressed, with longitudinal wrinkles.

* **PICEUS**. Black; thorax depressed, with three raised lines; the shells are piceous.

FLAVUS. Black; edges of the thorax and shells yellow; the latter with a brown fillet and outer margin; antennæ and legs yellow.

LITTOREUS. Black; shells grey on the fore-part; legs rufous. It inhabits the sea-shores.

B. *Hind-feelers hatchet-shaped.* **OXYPORUS.**

* **RUFUS**. Rufous; head and hind-part of the shells and abdomen are black. It is found chiefly on fungi, in this and other European countries.

* **LUNULATUS**. Yellow; shells black, pale at the base and tip. It inhabits Europe, on fungi. Head is black; the tip of the abdomen is marked with a white ring.

* **MERDARIUS**. Black; thorax and shells rufous. It is found in this and other European countries.

* **CHRYSOMELINUS**. Black; thorax rufous; shells testaceous, the margin at the base is black.

* **RUFIPES**. Glossy-black; legs rufous. It is found in the northern parts of Europe.

* **HYPNORUM**. Glossy-black; margin of the thorax, shells, and legs, testaceous; the body is black, glabrous, and polished.

* **MARGINELLUS**. Glossy-black; margins of the thorax and shells ferruginous. This is a very small insect.

C. *Fore-feelers clavate.* **PÆDERUS.**

* **RIPARIUS**. Rufous; shells blue; the head and end of the abdomen are blackish. This is figured in Donovan's English Insects.

* **FLONGATUS**. Hind-part of the shells and legs fulvous.

FULGESCENS. Glossy-black; shells and ends of the legs testaceous; head slightly punctured. The head is marked with numerous small impressed dots.

STAPHYLIS, a name given by some authors to a sort of cup, or boat, made for feeding young children, and contrived with a spout in form of a grape or nipple.

STAPHYLODENDRON. See **STAPHYLÆA**.

STAPHYLOMA, is the name given, in *Surgery*, to that disease of the eye, in which the cornea loses its natural transparency, rises above its proper level, and even projects between

tween the eye-lids, in the form of a whitish pearl-coloured tumour, which is attended with total loss of sight.

The malady commonly results from some violent species of ophthalmia, particularly that which is termed *purulent*, and affects children, and that which is consequent to the small-pox. As Scarpa observes, the staphyloma is one of the most serious dileates to which the eye-ball is subject; for, to the total and irremediable loss of sight, are added all the evils which necessarily result from the protuberance of the cornea in advanced cases. The inability of closing the eye-lids, the exposure of the eye-ball to the contact of the air and extraneous matter suspended in it, the friction of the eye-lashes against the tumour, the incessant flux of tears down the subjacent cheek, render the eye painful and inflamed; sympathetically induce ophthalmia in the sound one; and cause ulceration both on the diseased part of the eye, and on the lower eye-lid and cheek.

The opacity being irremediable, the only surgical object is to prevent the inconveniences arising from the protuberance of the diseased cornea. In recent cases, when the tumour does not project forward, it is best to do nothing. In inveterate cases, the prominent part of the cornea must be cut off. Scarpa recommends doing the operation as far from the conjunctiva as the case will allow. This eminent surgeon introduces a knife, like that used in the extraction of the cataract, completely across the staphyloma, at the distance of one line and a half, or two lines, from the centre of the tumour.

The lower half of the prominence is to be detached, by pushing the knife onward, till its edge comes out through the membrane below; then the flap is to be turned up with a pair of forceps, and the incision rendered completely circular with the same billoury. The aqueous humour, crystalline lens, and some of the vitreous humour, usually escape immediately after the operation, and the eye consequently becomes so diminished as to allow the eye-lids to be shut. Ophthalmia and suppuration of course succeed. Emollient poultices are now to be applied, until the violence of the inflammation has abated, the quantity of matter is diminished, and the wound manifests a disposition to heal: then they may be left off; and occasionally touching the sore with the *argentum nitratum*, and applying a pledget over the eye, will complete the cicatrization.

Mr. Ware thinks, that the portion of diseased cornea, taken away in the foregoing manner, is too diminutive to allow the crystalline lens to escape, without bruising the iris; and that it sometimes does not prevent the eye from becoming again distended with an aqueous fluid. He has, therefore, advised the circular incision of the cornea to be made about a quarter of an inch from the junction of that membrane with the sclerotic. Scarpa sulle Malattie principali degli Occhi. Ware in *Trans. of the Med. Society of London*, vol. i. art. 6. Cooper's First Lines of Surgery.

STAPHYLOSIS, a protuberance or protrusion of the choroid coat of the eye.

STAPIDACEUS MUSCULUS, in *Anatomy*, a name given by Duverney, Douglas, and many others, to the muscle of the stapes of the ear, called by others *stapidis musculus*, and by Albinus *stapidium*. See **STAPEDIUS** and **EAR**.

STAPLE, **STAPULA**, primarily signifies a public place, or market, whither merchants, &c. are obliged to bring their goods to be bought by the people; as the Greve, or the places along the Seine, for the wines and corns at Paris; whither the merchants of other parts are obliged to bring those commodities.

Vossius and Menage derive the word from *stapulus*, which is found in the Ripuary laws, signifying a place where jus-

tice is administered. Others derive it from the German *staple*, or Latin *stapula*, which Boxhornius derives farther from the German *stapelen*, to put in a heap. Others again have observed, that the English word staple is, in the civil law Latin style of former times, termed *stabile emporium*, i. e. a fixed port or mart for the importing of merchandize. And hence probably, they say, the contracted word *staple* (used, with some small variation in the orthography, all over Europe) had its derivation.

STAPLE also signifies a city or town, where merchants jointly agree to carry certain commodities, as wool, cloth, lead, tin, &c. in order to their being commodiously sold by the great. In England, staples were settled and appointed to be constantly kept in several towns, to which places merchants and traders were to carry goods to sell in those parts. See *Merchants of the STAPLE*.

The staple commodities of England were chiefly wool, leather, cloth, tin, lead, &c.; though by staple goods are now generally meant any proper saleable commodities, not easily subject to perish; or such wares and merchandize as are the natural and usual product or manufacture of any city or country.

The staples in the Levant, called by the French *eschelles*, i. e. *seales*, are such cities where the English, French, Dutch, Italians, &c. have consuls, factors, and magazines; and whither they send vessels regularly each year. The principal of these are Smyrna, Alexandretta, Aleppo, Seyda, Cyprus, Sallee, Alexandria, Cairo, Tunis, Algiers, Tripoli, the Morea, Candia, and the islands of the Archipelago. See **FACTORY**.

STAPLE, *Law of the*. See **LAW**.

STAPLE, *Merchants of the*, in the *History of English Commerce*, a denomination given to the first and most ancient commercial society in England, from their exporting the staple wares of the kingdom, which were wool, skins, lead, and tin, in their rough state for manufacture. This society is said to have had its rise in the year 1248; and it appears to have had the legal form of a corporation before the 12th year of Edward II. A.D. 1319; as there are records in the pipe-office of the Exchequer, which mention, that it was actually a corporation, with the title of the mayor and constables of the staple of England, who then had their staple at Antwerp, for conducting the sale of English staple wares, and the importation of such foreign goods as were wanted at home. However, in 1328, by 2 Edw. III. cap. 9. it was enacted, that the staples, on both sides of the sea, should cease, and that all merchant-strangers, &c. might go and come with their merchandize into England, after the tenor of the Great Charter. In 1336 the staple of wool was again fixed in Brabant; in 1341, at Bruges; and in 1348, at Calais; whither, and to no other place, all merchandize exported from England, Wales, and Ireland, either by denizens or aliens, were to be shipped from England and there landed. The customs from this staple are said to have then amounted to upwards of 60,000*l.* sterling yearly. In 1353, Edward III. removed the staple of wool from Bruges to Westminister, Canterbury, Chichester, Exeter, Winchester, Bristol, Lincoln, York, Norwich, Newcastle, and Hull, for England; and to Dublin, Cork, Waterford, and Drogheda, for Ireland. And it was enacted by 27 Edward III. called the *statute of the staple*, that all staple wares for exportation should be first brought to some of these places only, where the custom should be paid, and exported by merchant-strangers only, under an oath not to hold any staple thereof beyond sea; which privilege was extended by 31 Edward III. to denizens also. Calais, however, still remained a staple.

In these staple-towns, courts of *law-merchant* were established,

blished, by the said statute, for determining all mercantile affairs, and for punishing and amercing offenders. The principal matters under the cognizance of these courts were such as pertained to the five staple commodities of England, viz. wool and wool-fels or sheep-skins, leather, lead, and tin. From the year 1375, the staple of Westminster seems to have been removed to the place called Staple-Inn, in Holborn; when Calais, which had been for many years a principal staple-port for dispersing, in more early times, the English wool, lead, and tin, and, in later times, the English woollen manufactures, under the conduct of the Merchant-Adventurers, into the inland countries of the Netherlands, France, and Germany, was lost to this country. In 1588, the staple for wool, &c. was established at Bruges; and queen Elizabeth, in the third year of her reign, granted a new charter of confirmation to the corporation of the mayor and constables of the staple of England, of all such privileges as they did, might, or ought to have enjoyed before the loss of Calais. However, king James I., in 1604, granted a new charter to the Merchant-Adventurers, (which see,) and in 1617, confirmed all their former powers and privileges for trading to the Netherlands and to Germany, with the woollen manufactures of England, exclusively of all who were not free of their company; in consequence of which, the merchants of the staple, who had before been declining, by the manufacture and exportation of our woollen cloth, were brought to ruin. And when at length it was judged expedient to enact a total prohibition of the exportation of our wool, it is no wonder that the staplers' company should become extinct. At this day they exist only in name; though they maintain the form of a corporation by annually electing the officers of their company, according to the direction of their ancient charters. This nominal corporation is kept up by those who deal in wool (still called wool-staplers), and who, in their corporate capacity, possess a small sum in the public funds, the interest of which serves to defray the expence of their meetings and elections. But they never had a hall, or office of their own, within the city of London, like other trading companies, although the Inn of Chancery in Holborn is so denominated from their warehouses, which were formerly situated there; as was also an office and warehouse of theirs, which, since the erection of the new bridge at Westminster, has lost its place, as well as name of wool-staple, at the upper part of Cannon-Row. *Anderfon's Hist. Com. vol. i. See CUSTOMS.*

STAPLE, Statute. See **STATUTE**, and the preceding article.

STAPLE Articles of Food, in Agriculture, are all those which are of a firm and solid nature, texture, and quality, and which afford due support in the feeding and foddering of all sorts of domestic animals of the live-stock kind; in contradistinction to those which are of a watery and less firm structure and consistence, that supply nourishment and support to such animals in an inferior and less perfect manner; as corn, hay, tares, and some other similar sorts of food, in comparison with those of the more succulent root and grass kinds.

STAPLE of Land, a term signifying the particular nature and quality of it, in regard to the texture, consistence, and composition of its parts as a soil. In this way, there are heavy or strong stapled lands, those of a medium or middling staple, and light or thin stapled lands, according as the particles of the mouldy or powdery materials, of which they are constituted, may have more or less tenacity, adhesive firmness, and solidity among themselves, and more or less thickness. By this means, the differences in the staples of lands, as soils, become of very material importance to the farmer, as they shew and teach him not only the nature of the crops that may be grown upon them to the most

profit and advantage, and with the least danger, or greatest chance of success, but the manner in which they may be the most beneficially and effectually cultivated for the raising and producing of them. Besides, the differences in the staples of lands, as soils, are the chief or principal means by which the common farmer is able and capable of judging of, and deciding in respect to, the qualities of land as farms, as well as of their nature and values in the view of purchasing them. See **SOIL**.

STAPLE, Iron, in *Rural Economy*, a small piece of iron, in which the outward part is mostly either of the curved or square form, having two long sharp ends, points, or prongs; which are driven into wood or any other similar material. Staples of this sort are very useful for many different purposes about farms, as fastening gates, securing doors, and many others of the same nature.

STAPLES, or Keel-Staples, in *Ship-Building*, are generally made of copper, from six to twelve inches long, and about one and a quarter inch broad, with a jagged hook at each end, which are driven into the sides of the main and false keels to fasten them.

STAPLE-Rope, a term for ropes made of hemp not inferior to clean Petersburg.

STAPLETON, THOMAS, in *Biography*, was born of a good family at Henfield, in Sussex, in 1535. He was educated partly at Canterbury and partly at Winchester, and was then entered of New college, Oxford, of which he became a perpetual fellow. In the reign of queen Mary he obtained a prebend of Chichester, but on the accession of Elizabeth, his steady attachment to the Roman Catholic religion caused him and his family to remove to Louvain. Here he studied theology, and afterwards visited Paris and Rome. Returning to Louvain, he employed himself in writing books till 1572, when he was invited to Douay; where Philip II. had founded an university. After taking the degree of doctor in theology, he was presented to a canonry in that town, and was made royal professor of the holy scriptures. A distaste to the world induced him to enter among the Jesuits, who sent him to Louvain. This situation did not at all accord with his taste, and he returned to the canonry of Douay, whence, in 1590, he was called to occupy a royal professorship at Louvain: he was afterwards nominated to the deanery of Hilverbeck, near Bois-le-Duc, a preferment of considerable value, the profits of which placed him in good circumstances. He had now acquired a high reputation by his writings, which procured him an invitation to Rome from pope Clement VIII.; but he felt himself too old for such a change, and being beset with infirmities, he was led to decline the honour intended him. He died in 1598, at the age of sixty-three. He was a very voluminous writer, and his works, when collected, formed four volumes folio, which were printed at Paris in 1620. They all relate to the principles and controversies of the Romish religion, and the eulogies of its assertors. One of the most known was entitled "Propugnaculum Fidei primitivæ Anglorum," which was translated into English under the title of Stapleton's "Fortress of Faith." He gave an English version of Bede's Church History.

STAPLING of Wool, in *Rural Economy*, the art or process of sorting and adjusting its different properties and qualities in the same fleece, or in the whole quantity, so as that those of the same kind, and which are proper for the same use and intention in the manufactures, may be put together in the most useful and appropriate manner.

The Highland Society of Scotland has lately offered a premium for an essay on the best mode of executing the business, and the advantages that may be derived from it to that country. See **WOOL**.

STAPODIA, or *The Brothers*, in *Geography*, two islets in the Grecian Archipelago; 6 miles E. of Mycone. N. lat. $37^{\circ} 32'$. E. long. $36^{\circ} 42'$.

STAPPEN, a place of Iceland, farther along the coast towards the W. than Stadarfad (which see); situated on the brow of a range of curiously columnar rocks, large insulated masses of which stand in the sea, in various singular forms. Stappen, like Buderstad, is a trading station, and consists of a merchant's house, two or three store-houses, and a few cottages, inhabited by fishermen. The coast in the neighbourhood of Stappen is very remarkable; presenting, for an extent of about two miles, striking and beautiful columnar appearances, both in the cliffs which form the shore, and in the numerous insulated rocks which appear at different distances from the land. The ranges of columns, which in general are about 50 feet high, and perfectly regular in their forms, are variously broken, in consequence of their exposure to the action of the sea. In some places large caves have been formed; and in two of these the light is admitted by fissures in the roof, producing a very singular and striking effect. In general, the columns have a vertical position; but in different places they are disposed in bundles upon one another in all directions. In several instances they appear diverging from a centre; and they assume, in short, every form which such rocks can be imagined to take. About a mile and a half W. of Stappen, there is a curious perforated rock, forming a detached arch of considerable magnitude, the view through which is singularly picturesque, comprehending in the fore-ground many of the insulated masses of columnar rock, and in the distance, the fine range of mountains which stretches along the peninsula towards the east. On the beach at Stappen were several sharks, that had been taken for the sake of the oil of the liver, and the skin. Of the skin shoes were made; and some parts of the flesh were occasionally smoked, and used as food by the natives. But what they esteem a delicacy, presents a most horrible odour to strangers. Mackenzie's *Travel in Iceland*.

STAR, STELLA, in *Astronomy*, a general name for all the heavenly bodies.

The stars are distinguished, from the phenomena of their motion, &c. into *fixed* and *erratic*.

STARS, *Erratic*, or *Wandering*, are those whose distances and places, with regard to each other, are continually changing. These are what we properly call planets. Though to the same class may likewise be referred what we popularly call *blazing* stars, or comets.

STARS, *Fixed*, called also, by way of eminence, *stars*, are those which have been generally observed to keep the same distance with regard to each other, or because (except some few) they do not appear to have any proper motion of their own.

The principal points that have come under the consideration of astronomers concerning the fixed stars, are, their *distance*, *magnitude*, *number*, *nature*, and *motion*.

STARS, *Distance of the Fixed*. The fixed stars are bodies exceedingly remote from us; indeed so remote, that we have no distance in the planetary system to compare to them.

Their immense distance is argued hence, that they have no sensible parallax, that is, that the diameter of the earth's orbit bears no sensible proportion to it; but they are seen the very same in all the points of it. M. Huygens (*Cosmotheor. lib. iv.*) attempts to determine the distance of the stars, by making the aperture of a telescope so small, as that the sun through it appears no bigger than Sirius. In this state he found the sun's diameter to be as 1 to 27.664 of his diameter, when seen with the naked eye. Were the

sun's distance, then, 27.664 times as great as it is, it would be seen of the same diameter with Sirius; so that, allowing Sirius to be equal in magnitude with the sun (which is a very reasonable supposition), the distance of Sirius from the earth will be found to be to that of the sun from the earth, as 27.664 to 1. On which principle, Sirius will be 657,020,000 femidiameters of the earth distant from our earth.

Mr. James Gregory investigated the distance of Sirius, by supposing it of the same magnitude with the sun, and of the same diameter with Jupiter in opposition, as may be seen at large in Gregory's *Astr. lib. iii. prop. 47.*

Cassini (*Mém. de l'Acad. ann. 1717*), from comparing Jupiter and Sirius, when viewed through the same telescope, inferred, that the diameter of that planet was ten times as great as that of the star; and the diameter of Jupiter being 50", he concluded that the diameter of Sirius was about 5"; supposing then that Sirius is equal to the sun in magnitude, and the distance of the sun from us to be about 10,000 diameters of the earth, and the apparent diameter of Sirius being to that of the sun as 1 to 384, the distance of Sirius from the earth becomes equal to 3,840,000 diameters of the earth.

These methods of Gregory, Huygens, and Cassini, are conjectural and precarious, because they suppose that the sun and Sirius are equal in magnitude, and principally because they take it for granted, that the diameter of Sirius is determined with sufficient exactness.

Mr. Michell has proposed an enquiry into the probable parallax and magnitude of the fixed stars, from the quantity of light which they afford us, and the particular circumstances of their situation. With this view he supposes, that they are, at a medium, equal in magnitude and natural brightness to the sun; and then proceeds to enquire what would be the parallax of the sun, if he were to be removed so far from us, as to make the quantity of the light, which we should then receive from him, no more than equal to that of the fixed stars. Accordingly, he assumes Saturn in opposition, exclusively of his ring, (and when the earth and this planet are at their mean distances from the sun,) as equal, or nearly equal, in light to the most luminous fixed star. As the mean distance of Saturn from the sun is equal to about 2082 of the sun's femidiameters, the density of the sun's light at Saturn will consequently be less than at his own surface, in the proportion of the square of 2082 (or 4,334,724) to 1. If Saturn, therefore, was to reflect all the light that falls upon him, he would be less luminous in the same proportion; and, besides, his apparent diameter, in opposition, is at most but 105th part of that of the sun, and, consequently, the quantity of light which we receive from him, must be again diminished in the proportion of the square of 105 (or 11,025) to 1. By multiplying these two numbers together, we shall have the whole of the light of the sun to that of Saturn, as the square of nearly 220,000 (or 48,400,000,000) to 1; and removing the sun to 220,000 times its present distance, he would still appear at least as bright as Saturn, and his whole parallax upon the diameter of the earth's orbit would be less than 2"; and this must be allowed for the parallax of the brightest of the fixed stars, upon the supposition that their light does not exceed that of Saturn.

By a similar computation it may be found, that the distance at which the sun would afford us as much light as we receive from Jupiter, is not less than 46,000 times his present distance, and his whole parallax in that case, upon the diameter of the earth's orbit, would not be more than 9"; the light of Jupiter and Saturn, as seen from the earth,

earth, being in the ratio of about 22 to 1, when they are both in opposition, and supposing them to reflect equally in proportion to the whole of the light that falls upon them. But if Jupiter and Saturn, instead of reflecting the whole of the light that falls upon them, should really reflect only a part of it, *e. g.* a fourth or a sixth, which may be the case, their distances, computed above, must be increased in the proportion of 2 or $2\frac{1}{2}$ to 1, to make the sun's light no more than equal to their's; and his parallax would be less in the same proportion. Supposing, then, that the fixed stars are of the same magnitude and brightness with the sun, it is no wonder that their parallax should hitherto have escaped observation; since, if this is the case, it could hardly amount to 2", and probably not more than 1" in Sirius himself, though he had been placed in the pole of the ecliptic; and in those that appear much less luminous, *e. g.* γ Draconis, which is only of the third magnitude, it could hardly be expected to be sensible with such instruments as have hitherto been used. However, Mr. Michell suggests, that it is not impracticable to construct instruments, capable of distinguishing even to the 20th part of a second, provided the air will admit of that degree of exactness. This ingenious writer apprehends, that the quantity of light which we receive from Sirius, does not exceed the light which we receive from the least fixed stars of the sixth magnitude, in a greater proportion than that of 1000 to 1, nor in a less proportion than that of 400 to 1; and the smaller stars of the second magnitude seem to be about a mean proportional between the other two. Hence, the whole parallax of the least fixed stars of the sixth magnitude, supposing them of the same size and native bigness with the sun, should be from about 2" to 3", and their distance from about eight to twelve million times that of the sun: and the parallax of the smaller stars of the second magnitude, upon the same supposition, should be about 12", and their distance about two million times that of the sun.

This author farther suggests, that, from the apparent situation of the stars in the heavens, there is the highest probability (the odds against the contrary opinion being many million millions to one) that the stars are collected together in clusters in some places, where they form a kind of system, whilst in others there are either few or none of them, whether this disposition be owing to their mutual gravitation, or to some other law or appointment of the Creator. Hence it may be inferred, that such double stars, &c. as appear to consist of two or more stars placed very near together, do really consist of stars placed near together, and under the influence of some general law: and he proceeds to inquire, whether, if the stars are collected into systems, the sun does not likewise make one of some system, and which are those, among the fixed stars, that belong to the same system with himself.

Those stars, he apprehends, which are found in clusters, and surrounded by many others at a small distance from them, belong probably to other systems, and not to ours. And those stars which are surrounded with nebulae, are probably only very great stars, which, on account of their superior magnitude, are singly visible; while the others, which compose the remaining part of the same system, are so small as to escape our sight. And those nebulae in which we can discover either none or only a few stars, even with the assistance of the best telescopes, are probably systems that are still more distant than the rest.

For other particulars of this inquiry, we must refer to Phil. Transf. vol. lvii. art. 27. p. 234, &c.

As the distance of the fixed stars is best determined by their parallax, various methods have been pursued, hitherto

without success, for investigating it; and the result of the most accurate observations has given us little more than a distant approximation, from which we may conclude, that the nearest of the fixed stars cannot be less than 40,000 diameters of the whole annual orbit of the earth distant from us.

The method pointed out by Galileo, and first attempted by Hooke, Flamsteed, Molineux, and Bradley, of taking distances of stars from the zenith that pass very near it, has given us a much juster idea of the immense distance of the stars, and furnished us with an approximation to the knowledge of their parallax, that is much nearer the truth than we ever had before.

Dr. Bradley assures us (Phil. Transf. N^o 406, or Abr. vol. vi. p. 162.), that, if it had amounted to a single second, or two at most, he should have perceived it in the great number of observations which he made, especially upon γ Draconis; and that it seemed to him very probable, that the annual parallax of this star is not so great as a single second, and consequently, that it is above four hundred thousand times farther from us than the sun.

But Dr. Herschel, to whose ingenuity and industry in exploring the heavens astronomy is already much indebted, and from whom much more may be expected, remarks, that the instrument used on this occasion, being the same with the present zenith sectors, can hardly be allowed sufficient to shew an angle of one or even two seconds with accuracy: and besides, the star on which the observations were made, is only a bright star of the third or small star of the second magnitude; and, therefore, its parallax is probably considerably less than that of a star of the first magnitude: so that we are not warranted in inferring that the parallax of the stars in general does not exceed 1", whereas those of the first magnitude may have, notwithstanding the result of Dr. Bradley's observations, a parallax of several seconds.

Moreover, the method of zenith distances is liable to considerable errors, on account of refraction, the change of position of the earth's axis arising from nutation, precession of the equinoxes, and other causes, and the aberration of light.

Dr. Herschel has proposed another method, by means of double stars, which is free from these errors, and of such a nature, that the annual parallax, even if it should not exceed the tenth part of a second, may still become visible and be ascertained, at least to a much greater degree of approximation than it ever has been done. This method, which was first proposed in an imperfect manner by Galileo, and has been also mentioned by other authors, is capable of every improvement which the telescope and mechanism of micrometers can furnish. In order to obtain a general idea of it, let O, E, (*Plate XX. Astronomy, fig. 8.*) be two opposite points of the annual orbit, taken in the same plane with two stars *a, b*, of unequal magnitudes. Let the angle *aOb* be observed when the earth is at O, and *aEb* be observed when the earth is at E. From the difference of these angles, if there should be any, we may calculate the parallax of the stars, according to the theory subjoined. These two stars ought to be as near each other as possible, and also to differ as much in magnitude as we can find them.

Dr. Herschel's theory of the annual parallax of double stars, with the method of computing from thence what is generally called the parallax of the fixed stars, or of single stars of the first magnitude, such as are nearest to us, supposes, *first*, that the stars, one with another, are about the size of the sun: and, *secondly*, that the difference of their apparent magnitudes is owing to their different distances, so that the star of the second, third, or fourth magnitude, is two, three,

or four times as far off as one of the first. These principles, which he premises as postulata, have so great a probability in their favour, that they will hardly be objected to by those who are the least acquainted with the doctrine of chances. See Mr. Michell's Inquiry, &c. already cited. Phil. Transf. vol. vii. p. 234, 236, 237, 240. And Dr. Halley on the Number, Order, and Light of the Fixed Stars. Phil. Transf. vol. xxxi. or Abr. vol. vi. p. 148.

Accordingly, let OE (Plate XX. Astronomy, fig. 9.) be the whole diameter of the earth's annual orbit; and let a, b, c , be three stars situated in the ecliptic, in such a manner, that they may be seen all in one line $Oabc$, when the earth is at O . Let the line $Oabc$ be perpendicular to OE , and draw PE parallel to cO : then, if Oa, ab, bc , are equal to each other, a will be a star of the first magnitude, b of the second, and c of the third. Let us now suppose the angle OaE , or parallax of the whole orbit of the earth, to be $1''$ of a degree; then we have $PEa = OaE = 1''$; and because very small angles, having the same subtense OE , may be taken to be in the inverse ratio of the lines Oa, Ob, Oc , &c. we shall have $ObE = \frac{1}{2}''$, $OcE = \frac{1}{3}''$, &c. Now when the earth is removed to E , we shall have $PEb = EbO = \frac{1}{2}''$, and $PEa - PEb = aEb = \frac{1}{2}''$: i. e. the stars a, b , will appear to be $\frac{1}{2}''$ distant. We also have $PEc = EcO = \frac{1}{3}''$, and $PEa - PEc = aEc = \frac{2}{3}''$; i. e. the stars a, c , will appear to be $\frac{2}{3}''$ distant, when the earth is at E . Now, since we have $bEP = \frac{1}{2}''$, and $cEP = \frac{1}{3}''$, therefore $bEP - cEP = bEc = \frac{1}{6}'' - \frac{1}{9}'' = \frac{1}{18}''$; i. e. the stars b, c , will appear to be only $\frac{1}{18}''$ removed from each other, when the earth is at E . Whence we may deduce the following expression, to denote the parallax that will become visible in the change of distance between the two stars, by the removal of the earth from one extreme of its orbit to the other. Let P express the total parallax of a fixed star of the first magnitude, M the magnitude of the largest of the two stars, m the magnitude of the smallest, and p the partial parallax to be observed by the change in the distance of a double star;

then will $p = \frac{m - M}{M m} P$; and p , being found by observation, will give us $P = \frac{p M m}{m - M}$.

E. gr. Suppose a star of the first magnitude should have a small star of the twelfth magnitude near it: then will the partial parallax we are to expect to see be $\frac{12 \times 1 P}{12 - 1}$, or $\frac{1}{11}$ th of the total parallax of a fixed star of the first magnitude; and if we should, by observation, find the partial parallax between two such stars to amount to $1''$, we shall have the total parallax $P = \frac{1 \times 1 \times 12}{12 - 1} = 1''.0909$. If the stars are of the third and twenty-fourth magnitudes, the partial parallax will be $\frac{24 - 3}{3 \times 24} = \frac{21}{72} P$; and if, by observation, p is found to be a tenth of a second, the whole parallax will come out $\frac{1 \times 3 \times 24}{24 - 3} = 0''.3428$.

Farther, suppose the stars, being still in the ecliptic, to appear in one line, when the earth is in any other part of its orbit between O and E ; then will the parallax still be expressed by the same algebraic formula, and one of the maxima will still lie at O , the other at E : but the whole effect will be divided into two parts, which will be in proportion to each other as radius - sine to radius + sine of the stars' distance from the nearest conjunction or opposition.

When the stars are any where out of the ecliptic, situated so as to appear in one line $Oabc$ perpendicular to OE , the maximum of parallax will still be expressed by $\frac{m - M}{M m} P$;

but there will arise another additional parallax in the conjunction and opposition, which will be to that which is found 90° before or after the sun, as the sine (S) of the latitude of the stars seen at O is to the radius (R); and the effect of this parallax will be divided into two parts; half of it lying on one side of the large star, the other half on the other side of it. This latter parallax, moreover, will be compounded with the former, so that the distance of the stars in the conjunction and opposition will then be represented by the diagonal of a parallelogram, of which the two semi-parallaxes are the sides; a general expression for which

will be $\sqrt{\left(\frac{m - M}{2 m M} P\right)^2 \times \frac{S S}{R R} + 1}$; for the stars will ap-

parently describe two ellipses in the heavens, whose transverse axes will be to each other in the ratio of M to m (fig. 10.) and Aa, Bb, Cc, Dd , will be contemporary situations. Now, if bQ be drawn parallel to AC , and the parallelogram $bqBQ$ be completed, we shall have $bQ = \frac{1}{2} CA - \frac{1}{2} ca = \frac{1}{2} Cc = \frac{1}{2} p$, or semi-parallax 90° before or after the sun, and Bb may be resolved into, or is compounded of, bQ and bq ; but $bq = \frac{1}{2} BD - \frac{1}{2} bd =$ the semi-parallax in the conjunction or opposition. We also

have $R : S :: bQ : bq = \frac{p S}{2 R}$; therefore the distance Bb (or

Dd) = $\sqrt{\left(\frac{p}{2}\right)^2 + \left(\frac{p S}{2 R}\right)^2}$; and by substituting the value

of p into this expression, we obtain $\sqrt{\left(\frac{m - M}{2 M m} P\right)^2 \times \frac{S S}{R R} + 1}$,

as above. When the stars are in the pole of the ecliptic, bq will become equal to bQ , and Bb will be $.7071 P \frac{m - M}{M m}$. Again, let the stars be at some distance, *e. g.* $5''$, from each other, and let them both be in the ecliptic. This case is resolvable into the first; for imagine the star a (fig. 11.) to stand at x , and in that situation the stars x, b, c , will be in one line, and their parallax expressed by $\frac{m - M}{M m} P$.

But the angle aEx may be taken to be equal to aOx ; and as the foregoing formula gives us the angles xEb, xEc , we are to add aEx or $5''$ to xEb , and we shall have aEb . In general, let the distance of the stars be d , and let the observed distance at E be D ; then will $D = d + p$, and therefore the whole parallax of the annual orbit will be

expressed by $\frac{D M m - d M m}{m - M} = P$.

Suppose the two stars now to differ only in latitude, one being in the ecliptic, the other, *e. g.* $5''$ north, when seen at O . This case may also be resolved by the former; for imagine the stars b, c , (fig. 9.) to be elevated at right angles above the plane of the figure, so that aOb , or aOc , may make an angle of $5''$ at O ; then instead of the lines $Oabc, Ea, Eb, Ec, EP$, imagine them all to be planes at right angles to the figure; and it will appear, that the parallax of the stars in longitude must be the same as if the small star had been without latitude. And since the stars b, c , by the motion of the earth from O to E , will not change their latitude, we shall have the following construction for finding the

the distance of the stars ab, ac , at E , and from thence the parallax P . Let the triangle $ab\beta$ (Plate XX. *Astronomy*, fig. 12.) represent the situation of the stars; ab is the subtense of $5''$, the angle under which they are to be seen at O .

The quantity $b\beta$ by the former theorem is found $\frac{m-M}{Mm} P$,

which is the partial parallax that would have been seen by the earth's moving from O to E , if both stars had been in the ecliptic; but on account of the difference in latitude, it will be now represented by $a\beta$, the hypotenuse of the triangle $ab\beta$: therefore in general, putting $ab = d$, and $a\beta$

$= D$, we have $\sqrt{\frac{DD - dd \times Mm}{m - M}} = P$. Hence, D

being taken by observation, and d, M , and m , given, we obtain the total parallax.

If the situation of the stars differs in longitude as well as latitude, we may resolve this case by the following method. Let the triangle $ab\beta$ (Plate XX. *Astronomy*, fig. 13.) represent the situation of the stars, $ab = d$ being their distance seen at O , $a\beta = D$ their distance seen at E . That the change $b\beta$, which is produced by the earth's motion, will

be truly expressed by $\frac{m-M}{Mm} P$, may be proved as before,

by supposing the star a to have been placed at α . Now let the angle of position $ba\alpha$ be taken by a micrometer, or by any other method sufficiently exact; then, by solving the triangle $ab\alpha$, we shall have the longitudinal and latitudinal differences $a\alpha$ and $b\alpha$ of the two stars. Put $a\alpha = x$, $b\alpha = y$, and it will be $x + b\beta = a\alpha$, whence $D =$

$\sqrt{x + \frac{m-M}{Mm} P}^2 + yy$; and $\sqrt{\frac{D^2 - y^2 \times Mm - xMm}{M - m}} = P$.

If neither of the stars should be in the ecliptic, nor have the same longitude or latitude, the last theorem will still serve to calculate the total parallax whose maximum will lie in E . There will, moreover, arise another parallax, whose maximum will be in the conjunction and opposition, which will be divided, and lie on different sides of the large star; but as we know the whole parallax to be exceedingly small, it will not be necessary to investigate every particular case of this kind; for, by reason of the division of the parallax, which renders observations taken at any other time, except where it is greatest, very unfavourable, the formulæ would be of little use. Dr. Herschel closes his account of this theory with a general observation on the time and place where the maxima of parallax will happen.

When two unequal stars are both in the ecliptic, or, not being in the ecliptic, have equal latitudes, north or south, and the largest star has most longitude, the maximum of the apparent distance will be when the sun's longitude is 90° more than the stars, or when observed in the morning: and the minimum when the longitude of the sun is 90° less than that of the star, or when observed in the evening. When the small star has most longitude, the maximum and minimum, as well as the time of observation, will be the reverse of the former. When the stars differ in latitude, this makes no alteration in the place of the maximum or minimum, nor in the time of observation; *i. e.* it is immaterial whether the largest star has the least or the greatest latitude of the two stars. Phil. Transf. vol. lxxii. part i. art. 11.

The distance of the star γ Draconis appears by Dr. Bradley's observations, already recited, to be at least four hundred thousand times that of the sun, and the distance of the nearest fixed star not less than forty thousand diameters of

the earth's annual orbit: *i. e.* the former is distant from the earth at least 38,000,000,000,000 miles, and the latter not less than 7,600,000,000,000 miles. As these distances are immensely great, it may not be unamusing to compare them with the velocity of some moving body by which they may be measured.

The swiftest motion we know of is that of light, (see LIGHT,) which passes from the sun to the earth in eight minutes thirteen seconds, and yet this would be above six years traversing the first space, and nearly $1\frac{1}{4}$ year in passing from the nearest fixed star to the earth. A cannon-ball discharged from a twenty-four pounder, with two-thirds its weight of powder, which moves at the rate of about nineteen miles in a minute (see GUN), would be three million eight hundred thousand years passing from γ Draconis to the earth, and seven hundred and sixty thousand years passing from the nearest fixed star. Sound, which moves at the rate of about thirteen miles in a minute, would be five million six hundred thousand years traversing the former distance, and one million one hundred and twenty thousand passing through the latter.

The celebrated Huygens pursued speculations of this kind so far, as to believe it not impossible, that there may be stars at such inconceivable distances, that their light has not yet reached the earth since its creation.

Dr. Halley also advanced, what he says (Phil. Transf. No. 364. or Abr. vol. vi. p. 418.) seems to be a metaphysical paradox, *viz.* that the number of fixed stars must be more than any finite number, and some of them more than at a finite distance from others: and Mr. Addison has justly observed, that this thought is far from being extravagant, when we consider that the universe is the work of infinite power, prompted by infinite goodness, having an infinite space to exert itself in; so that our imagination can set no bounds to it.

STARS, *The Magnitudes of the Fixed*, appear to be very different, which difference may probably arise, not only from a diversity in their real magnitudes, but principally from their distances, which are different.

The stars appear of a sensible magnitude to the bare eye, because the retina is affected not only by the rays of light which are emitted directly from them, but by many thousands more, which, falling upon our eye-lids, and upon the aerial particles about us, are reflected into our eyes so strongly, as to excite vibrations, not only in those points of the retina where the real images of the stars are formed, but also in other points at some distance round about. This makes us imagine the stars to be much bigger than they would appear, if we saw them only by the few rays which come directly from them, so as to enter our eyes without being intermixed with others.

Any one may be sensible of this by looking at a star of the first magnitude through a long narrow tube, which, though it takes in as much of the sky as would hold a thousand such stars, scarcely renders that one visible.

The more a telescope magnifies, the less is the aperture through which the star is seen, and consequently the fewer rays it admits into the eye. Since, therefore, the stars appear less in a telescope which magnifies 200 times, than they do to the bare eye, inasmuch that they seem to be only indivisible points, we may infer that they are at immense distances from us, and also that they shine by their own proper light. If they shone by borrowed light, they would be as invisible without telescopes as the satellites of Jupiter are: for these satellites appear bigger when viewed with a good telescope than the largest fixed stars do.

The stars, on account of their apparently various magnitudes,

nitudes, have been distributed into several classes, called *magnitudes*.

The first class, or stars of the first magnitude, are those which appear largest, and may probably be nearest us. Next these, are those of the second magnitude, and so on to the sixth, which comprehends the smallest stars visible to the naked eye. All beyond these are called *telescopic* stars. Not that all the stars of each class appear justly of the same magnitude; there is great latitude in this respect; and those of the first magnitude appear almost all different in lustre and size. Other stars there are, of intermediate magnitudes, which astronomers cannot refer to one rather than another class, and therefore they place them between the two.

Procyon, for instance, which Ptolemy makes of the first magnitude, and Tycho of the second, Mr. Flamsteed lays down as between the first and second.

Thus, instead of six several magnitudes, we may say there are almost as many orders of stars as there are stars; such a difference being observable in the magnitude, colour, and brightness of them.

Whatever room there may be to hope, that we may some time or other be able to discover the parallax of a few among the fixed stars, yet at the same time it seems probable, that we shall never be able to discover any sensible magnitude in their apparent diameters, which, even in Sirius, if his native brightness is not less than that of the sun, must be considerably less, whatever be his parallax, than the hundredth, probably than the two hundredth part of a second; so that it could scarcely be distinguishable with a telescope, upon the former supposition, that should magnify six, or, upon the latter, with one that should magnify twelve thousand times. Nor can we well expect to find their apparent diameters from any occultation by the moon, since the diameter of a hundredth part of a second would be covered by the moon, if it entered directly, in less than the fiftieth part of a second of time, and, therefore, a star can hardly enter so obliquely, as to appear to vanish by degrees: no star, probably, which the moon can pass over, subtending an angle half so great. Nor is it likely there can any thing be determined from occultations by any of the planets. And, therefore, there seems to be little chance of discovering with certainty the real size of any of the fixed stars, and we must be content to deduce it from their parallax (if that should ever be found) and the quantity of light which they afford us, compared with that of the sun. Dr. Herschel, however, informs us, that with a magnifying power of 6450, and by means of his new micrometer, he found the apparent diameter of α Lyræ to be $0''.355$.

The stars are likewise distinguished, with regard to their situation, into *asterisms*, or *constellations*, which are nothing but assemblages of several neighbouring stars, considered as constituting some determinate figure, as of an animal, &c. and denominated from it; a division as ancient as the book of Job, in which we find mention of Orion, and the Pleiades, &c. See CONSTELLATION.

Besides the stars thus distinguished into magnitudes and constellations, there are others not reduced to either. Those not reduced into constellations, are called *informes*, (which see,) or *unformed stars*; of which kind several, so left at large by the ancients, have been since formed into new constellations by the modern astronomers; as *Cor Caroli*, by Dr. Halley; *Scutum Sobiesci*, by Hevelius, &c.

In describing the particular stars, it will be most convenient to begin with such as never set in our climates, and we may then refer the situations of others to their positions with respect to these.

The Great Bear is the most conspicuous of the constella-

tions which never set; it consists of seven stars, placed like the four wheels of a waggon, and its three horses, except that the horses are fixed to one of the wheels. The two hind-wheels are the pointers, which direct us to the pole-star, in the extremity of the tail of the Little Bear: and further on, to the constellation Cassiopeia, which is situated in the milky way, where it is nearest to the pole, and which consists of several stars, nearly in the form of the letter W. The two northernmost wheels of the Great Bear, or wain, point at the bright star Capella, the goat, in Auriga. Descending along the milky way from Cassiopeia, if we go towards Capella, we come to Algenib, in Perseus; and a little further from the pole we find Algol, or Medusa's head: but if we take the opposite direction, we arrive at Cygnus, the swan; and beyond it, a little out of the milky way, is the bright star Lyra. The Dragon consists of a chain of stars partly surrounding the Little Bear; and between Cassiopeia and the Swan is the constellation Cepheus.

Near Algenib, and pointing directly towards it, are two stars of Andromeda, and a third is a little beyond them. A line drawn through the Great Bear and Capella passes to the Pleiades, and then, turning at a right angle towards the milky way, reaches Aldebaran, or the bull's eye, and the shoulders of Orion, who is known by his belt, consisting of three stars, placed in the middle of a quadrangle. Aldebaran, the Pleiades, and Algol, make the upper, and Menkar, or the whale's jaw, with Aries, the lower points of a W. In Aries we observe two principal stars, one of them with a smaller attendant.

A line drawn from the pole, midway between the Great Bear and Capella, passes to the Twins and to Procyon; and then, in order to reach Sirius, it must bend across the milky way. Algol and the Twins point at Regulus, the lion's heart, which is situated at one end of an arch, with Denebola at the other end.

The pole-star and the middle horse of the wain direct us to Spica Virginis, considerably distant: the pole and the first horse nearly to Arcturus, in the waggoner, or Bootes. Much further southwards, and near the milky way, is Antares, in the Scorpion, forming, with Arcturus and Spica, a triangle, within which are the two stars of Libra. The Northern crown is nearly in a line between Lyra and Arcturus, and the heads of Hercules and Serpentarius are between Lyra and Scorpio.

In the milky way, below the part nearest to Lyra, and on a line drawn from Arcturus through the head of Hercules, is Aquila, making with Lyra and Cygnus a conspicuous triangle. The last of the three principal stars in Andromeda makes, with three of Pegafus, a square, of which one of the sides points to Fomalhaut, situated at a considerable distance in the southern fish, and in the neighbourhood of the whale, which has already been mentioned.

By means of these alineations, all the principal stars that are ever visible in Britain may be easily recognised. Of those which never rise above our horizon, there are several of the first magnitude; Canopus, in the ship Argo, and Achernar, in the river Eridanus, are the most brilliant of them; the feet of the Centaur, and the Croser are the next; and, according to Humboldt's observations, perhaps some others may require to be admitted into the same class.

Those stars not reduced to classes or magnitudes, are called *nebulous* stars, being such as only appear faintly in clusters, in form of little lucid nebulae, or clouds. See NEBULÆ.

Ptolemy sets down five cloudy stars, viz. one at the extremity of the right hand of Perseus, which appears, through the telescope, thickly set with stars; one in the middle of the Crab, called *Præsepe*, or the Manger, in which Galileo

counted above forty stars; one unformed near the sting of the Scorpion; the eye of Sagittarius, in which two stars may be seen in a clear sky with the naked eye, and several more with the telescope; and one in the head of Orion, in which Galileo counted twenty-one stars.

Flamsteed observed a cloudy star before the bow of Sagittarius, which consists of a great number of small stars, and the star *d* above Sagittarius's right shoulder is encompassed with several more.

Cassini and Flamsteed discovered one between the Great and Little Dog, which is very full of stars, visible only by the telescope.

But the most remarkable of all the cloudy stars is that in the middle of Orion's sword, in which Huygens, and since Dr. Long, observed twelve stars, seven of which (three of them, now known to be four, being very close together) seem to shine through a cloud, very lucid near the middle, but faint and ill-defined about the edges. (See GALAXY, MAGELLANIC Clouds, and Lucid SPOTS.) Cassini is of opinion, that the brightness of these proceeds from stars so minute, as not to be distinguished by the best glasses: others more probably think, they are large spaces in the ether through which a lucid medium is diffused. Although most of these spaces are but a few minutes of a degree in breadth, yet, since they are among the fixed stars, they are probably spaces not less than our whole solar system; in which there seems to be a perpetual uninterrupted day, which may furnish matter of speculation, as well to the curious naturalist, as to the astronomer.

There are also several stars which appear single to the naked eye, but are discovered by the telescope to be double, &c. Of these several have been observed by Cassini, Hooke, Long, Maskelyne, Hornsby, Pigott, Mayer, &c.; but Dr. Herschel has been much the most successful in observations of this kind. Besides the skill and industry by which he is no less distinguished than other astronomers who have been employed in celestial observations, his success has been chiefly owing to the very extraordinary magnifying powers of the Newtonian seven-foot reflector which he has used, and the advantage of an excellent micrometer of his own construction. The powers which he has used have been 146, 227, 278, 460, 754, 932, 1159, 1536, 2010, 3168, and even 6450. His observations appear to commence with the year 1776, but almost all of them were made in the years 1779, 1780, 1781; and they have been since continued with the same skill and general assiduity. For the result, we refer to the articles DOUBLE Stars, GALAXY, HEAVENS, NEBULA, NEBULOSITY, and the sequel of this article.

STAR, *Double*, or a *Binary Sidereal System*, is formed by two stars situated so near to each other, as to be kept together by their mutual gravitation. The two bodies may revolve round their common centre of gravity in circles, or in similar ellipses, the dimensions of their orbits being proportional to their relative quantities of matter. From a series of observations on double stars, Dr. Herschel has found that they have changed their situations with regard to each other, that the one performs a revolution round the other, and that the motion of some of them is direct, while that of others is retrograde. In the course of observations pursued for twenty-five years, he discovered that in more than fifty of the double stars, there is a change either in the distance of the two stars, or in the angle made by a line joining them with the direction of their daily motion, which he calls "the angle of position." The interesting observations that have been published (Phil. Transf. vol. lxxiii.) relate to six double stars, α Geminorum, γ Leonis, ϵ Bootes, ζ Herculis, δ Serpentis, and γ Virginis. In respect to the first

of these, Castor or α Geminorum, the angle of position was found to have diminished in the space of 43 years 142 days, $45^{\circ} 39'$; and from the regularity of its decrease, he thinks it highly probable that the orbits in which the two stars move round their common centre of gravity are nearly circular, and at right angles to the line in which we see them; and that the time of a whole apparent revolution of the small star round Castor will be nearly 342 years and 2 months, in a retrograde direction. From the year 1778 to 1803, he never could perceive any variation in the distance of the two stars, which was uniformly $1\frac{2}{3}$ of the diameter of the large one. The distance of the two stars which compose γ Leonis has undergone a decided change from February 16th, 1782, to March 26th, 1803. The diameters of the two stars were as 5 to 4. The angle of position had diminished in this time from $7^{\circ} 37' N.$ following, to $6^{\circ} 21' S.$ following. From the interval between the two stars, the ratio of their diameters, and the variation in the angle of position, Dr. Herschel has found that the apparent orbit of the small star is elliptical, and that it performs a whole revolution in about 1200 years, in a retrograde direction. The beautiful double star of ϵ Bootes is composed of two stars, one of which is of a light red, and the other of a fine blue, having the appearance of a planet and its satellite. The distance between the two stars, observed with a power of 460, and an aperture of 6.3 inches, in 1781, was $1\frac{1}{2}$ the diameter of the large star, and in 1803, the interval had increased to $1\frac{3}{4}$ of that diameter. The ratio of the size of the stars is as 3 to 2. The angle of position appeared to have suffered a change of $12^{\circ} 33'$, in the space of 22 years and 207 days. From these facts Dr. Herschel concludes that the orbit of the small star is elliptical, and performs its revolution, according to the order of the signs, in 1681 years. The double star ζ Hercules is composed of a greater and a lesser star; the former being of a beautiful blueish-white, and the latter of a fine ash-colour. On the 18th July, 1782, the interval between the two stars was one half the diameter of the smaller one, with a power of 460. On the 21st July of the same year, their distance remained the same, but with a power of 1987; they were one full diameter of the small star asunder. In 1795, Dr. Herschel found it difficult to perceive the small star. In the month of October 1795, however, he saw it distinctly with a power of 460. In 1802, he could no longer perceive the small star, but in a clear night in September of that year, with a power of 460, the apparent disc of ζ Hercules seemed to be a little lengthened in one direction. With the ten-foot telescope, and a power of 600, it had the appearance of a lengthened, or rather wedge-formed, star. With a power of 2140, he again examined it on the 11th of April, 1803, and found the disc a little distorted; but he was convinced that not more than three-eighths of the apparent diameter of the small star was wanting to a complete occultation. The angle of position, on the 21st July, 1782, was $20^{\circ} 42'$ north following.

The double star of δ Serpentis has, like ϵ Bootes, undergone a considerable change in the angle of position, without any variation in the distance between the two stars. On the 5th September, 1782, the angle of position was $42^{\circ} 48'$ south preceding; and on the 7th February 1802, it was $61^{\circ} 27'$ south preceding, having sustained a diminution of $18^{\circ} 39'$ in the space of 19 years and 155 days. Hence the period of a complete revolution of the smaller star will be about 375 years.

The double star of γ Virginis, which has long been known to astronomers, is composed of two stars, which Dr. Herschel at first considered as nearly equal, though he has since ascertained that the one is a little larger than the other. Their distance,

STARS.

distance, which is about $2\frac{1}{2}$ diameters, has continued the same for 21 years, while the angle of position has varied considerably. On the 21st November, 1781, the angle of position was $40^{\circ} 44'$ south following, or rather north preceding, since the other star was afterwards found to be the smaller of the two; and on the 15th April, 1803, the angle of position was $30^{\circ} 20'$ north preceding, having suffered a diminution of $10^{\circ} 24'$ in 21 years and 145 days. From an observation of Mayer's, however, in 1756, Dr. Herschel has found the angle of position for that year to be $54^{\circ} 21' 37''$ north preceding, which gives a motion of $24^{\circ} 2'$ in 47 years and 105 days. Hence he concludes, that a complete revolution is performed in about 708 years.

For a catalogue, such as our limits would allow, of the principal double stars, see the article *DOUBLE Stars*.

For an account of clustering stars, clusters of stars, and groups of stars, and also treble, quadruple, quintuple, and multiple systems of stars, we must refer to the articles *GALAXY* and *HEAVENS*; and for a more particular detail, and catalogues of them, to Dr. Herschel's papers, or to the 2d volume of Fergufon's *Astronomy*, by Dr. Brewster.

STARS, Insulated, a name applied by Dr. Herschel to those celestial bodies which are in a great degree out of the reach of the attractive force of other stars, such as our Sun, Arcturus, Capella, Lyra, Sirius, Canopus, Markab Bellatrix, Menkar, Shedir, Algorah, Propus, and probably many others. It is obvious that no two stars in the universe can be altogether out of the sphere of each other's attraction; but in the case of Sirius and our sun, which, upon the supposition that their masses are equal, and that the former has a parallax of $1''$, would take 33 millions of years to fall to one another by their mutual action, we are entitled to say that they are insulated. Insulated stars are considered by Dr. Herschel as the centres of extensive planetary systems like our own; an opinion which he deduces from analogy, and from the nature of other sidereal combinations. Instead of supposing, therefore, as has generally been done, that every star in the firmament is encircled with planets, satellites, and comets, Dr. Herschel believes that the insulated stars alone are surrounded with such numerous attendants.

STARS, called Nebulae. (See *NEBULÆ*, *NEBULOSITY*, and the articles to which we have above referred.) Mr. Michell has shewn, from the computation of probabilities, that it is many million million chances to one, that the stars, which appear to form double stars, &c. clusters and nebulae in the heavens, are really collected together into separate systems. In the case of the Pleiades, for example, he computes that it is 500,000 to 1, that no six stars out of the number of those that are equal to the faintest of them in splendour, scattered at random in the whole heavens, should be within so small a distance from each other as the Pleiades are.

A similar opinion was maintained by professor Kant and M. Lambert, who supposed that all the stars in the universe are collected into nebulae; and that all the insulated or scattered stars which appear in the heavens, belong to the particular nebula in which our system is placed. We are indebted, however, solely to the genius and industry of Dr. Herschel, for perfecting these sagacious views, and supporting them by a body of evidence amounting nearly to demonstration. He has observed the position, magnitude, and structure of no fewer than 2500 nebulae. He generally detected them in certain directions, rather than in others; and in many parts of the heavens there were vacant spaces, both preceding and following the nebulous strata. Dr. Herschel supposes the nebula in Cancer, and that of Coma Berenices, to belong to two strata which are nearest the nebula of the Milky Way.

The following catalogue of nebulae, copied from Dr. Brewster's edition of Fergufon's *Astronomy*, is founded chiefly on the observations of Messier, as given in the "*Connoissance des Temps*" for 1784, the more recent observations of Dr. Herschel being always added. The *first* column contains the number of the nebulae, and the time when the observation was made; the *second* and *third*, its right ascension and declination for that time, which are more convenient than their longitude and latitude for finding them on a celestial globe. The *fourth*, its diameter in degrees and minutes; and the last, some general remarks on its appearance. All the nebulae in this class may be seen with good telescopes of a moderate size.

Catalogue of 103 Nebulae, the Positions of which have been determined by Messier.

No. and Year when observed.	Position of the Nebulae.	Right Ascen. in Degrees.	Declination.	Diamet.	General Remarks.
1. 1758.	Above the Bull's south- ern horn, west of ζ - }	80 0 33	21 45 27 N.		{ A whitish light, elongated like the flame of a taper. It exhibited a mottled nebulousity to Dr. Herschel.
2. 1760.	In the head of Aquarius, } near the 24th star - }	320 17 0	1 47 0 S.	4'	{ It is like the nucleus of a comet, surrounded with a large round nebula. Dr. H. resolved it into stars.
3. 1764.	Between Arcturus and } Cor Caroli - }	202 51 19	29 32 57 N.	3'	{ It is round, bright in the centre, and fades away gradually. It exhibited a mottled nebulousity to Dr. H.
4.	Near Antares - - -	242 16 56	25 55 40 S.	$2\frac{1}{2}'$	A mass of small stars.
5.	Near 6 Serpent - - -	226 39 4	2 57 16 N.	3'	A round nebula. Resolved into stars by Dr. H.
6.	Between the bow of Sa- gittarius and the tail of } Scorpio - - - }	261 10 39	32 10 34 S.	15'	A mass of small stars.
7.	Near the preceding - - -	264 30 24	34 40 34 S.	30'	A mass of small stars.
8.	Between the bow of Sa- gittarius, and the right } foot of Ophiuchus - }	267 29 30	24 21 10 S.	30'	{ An elongated mass of stars. Near this mass is the 9th of Sagittarius, which is encircled with a faint light.

STARS.

No. and Year when observed.	Position of the Nebulae.	Right Ascen. in Degrees.	Declination.	Diamet.	General Remarks.
9.	In the right leg of Ophiuchus	256 20 36	18 13 26 S.	3'	{ Round and faint; but resolved by Dr. Herschel into stars.
10.	In the girdle near 30 Ophiuchus	251 12 6	3 42 18 S.	4'	{ A fine and round nebula. Resolved into stars by Dr. H.
11.	Near K. Antinous	279 35 43	6 31 1 S.	4'	{ A mass of many small stars, mixed with a faint light.
12.	Between the arm and the left side of Ophiuchus	248 43 10	2 30 28 S.	3'	{ Round and faint. Near it is a star of the 9th magn. Resolved by Dr. H. into stars.
13.	In the girdle of Hercules, between two stars of the 8th magnitude	248 18 48	36 54 44 N.	6'	{ Round and bright in the middle. Resolved by Dr. H. into stars.
14.	In the drapery over the R. arm of Ophiuchus	261 18 29	3 5 45 S.	7'	{ Round and faint. Near a star of the 9th magn. Resolved into stars by Dr. H.
15.	Between the head of Pegasus, and that of the Little Horse	319 40 19	10 40 3 N.	3'	{ Round and bright in the centre. Resolved into stars by Dr. H.
16.	Near the Serpent's tail	271 15 3	13 51 44 N.	8'	{ A mass of small stars, mixed with a faint light, resolved by Dr. H.
17.	North of the bow of Sagittarius	271 45 48	16 14 44 S.	5'	A train of faint light, with stars.
18.	Above the preceding	271 34 3	17 13 14 S.	5'	{ A mass of small stars surrounded with nebulosity.
19.	Between Scorpio and the R. foot of Ophiuchus	252 1 45	25 54 46 S.	3'	Round, and resolved into stars by Dr. H.
20.	Between the bow of Sagittarius and the right foot of Ophiuchus	267 4 5	22 59 10 S.		{ A mass of stars of the 8th and 9th magnitude, surrounded with nebulosity.
21.	Near 11 Sagittarius	267 31 35	22 31 25 S.		The same as the preceding.
22.	Near 25 Sagittarius	275 28 39	24 6 11 S.	6'	Round, and resolved into stars by Dr. H.
23.	Near 65 Ophiuchus	265 42 50	18 45 55 S.	15'	A mass of stars very near each other.
24.	Near the end of the bow of Sagittarius in the Milky Way	270 26 0	18 26 0 S.	10 30'	{ Great nebulosity, containing several stars. The light is divided into several parts. Resolved into stars by Dr. H.
25.	Near the preceding, near 21 Sagittarius	274 25 0	19 5 0 S.	10'	A mass of small stars.
26.	Near η and σ Antinous	278 5 25	9 38 14 S.	2'	A mass of small stars.
27.	Near 14 of the Fox	297 21 41	22 4 0 N.	4'	{ Oval. It exhibited a mottled nebulosity to Dr. H.
28.	A degree from λ Sagittarius	272 29 30	24 57 11 S.	2'	Round, and resolved into stars by Dr. H.
29.	Below γ Cygni	303 54 29	37 11 57 N.		A mass of 7 or 8 small stars.
30.	Near 41 Capricorn	321 46 18	24 19 4 S.	2'	Round, and resolved into stars by Dr. H.
31.	In Andromeda's girdle	7 26 32	39 9 32 N.	40'	{ It resembles two cones of light joined at their base, which is 15' broad. Resolved into stars by Dr. H.
32.	Below the preceding	7 27 32	38 45 34 N.	2'	Round, without stars, and with a faint light.
33.	Below the head of the N. Fish and the Great Triangle	20 9 17	29 32 23 N.	15'	{ Its light is uniform and whitish. It exhibited a mottled nebulosity to Dr. H.
34.	Between Medusa's head and the left foot of Andromeda	36 51 37	41 39 32 N.	15'	A mass of small stars.
35.	Near μ and ν Castor	88 40 9	24 33 30 N.	20'	A mass of small stars near Castor's left foot.
36.	Near ϕ Bootes	80 11 42	34 8 6 N.	9'	A mass of small stars.
37.	Near the preceding	84 15 12	32 11 51 N.	9'	{ A mass of small stars with a nebulosity, resolved into stars by Dr. H.
38.	Near σ Auriga	78 10 12	36 11 51 N.	15'	A square mass of small stars.
39.	Near the Swan's tail	320 57 10	47 25 0 N.	10 0'	A mass of small stars.
40.	At the root of the Great Bear's tail	182 45 30	59 23 50 N.		Two stars very near one another
41.	Below Sirius	98 58 12	20 33 0 S.		A mass of small stars.

STARS.

No. and Year when observed.	Position of the Nebulae.	Right Ascen. in Degrees.	Declination.	Diamet.	General Remarks.
1765. 42.	Between θ and ϵ in Orion's sword - - - }	80 59 40	5 34 6 S.	6'	{ A beautiful nebula, containing seven small stars.
1769. 43.	Above the preceding - - -	81 3 0	5 26 37 S.		A star surrounded with nebulosity.
44.	Between γ and δ Cancer - - -	126 50 30	20 31 38 N.		A mass of small stars.
45.	The Pleiades - - -	53 27 4	23 22 41 N.		Cluster of stars.
46. 1771.	{ Between the G. Dog's head and the hind feet of the Unicorn - - }	112 47 43	14 19 7 S.		A mass of stars, with a little nebulosity.
47.	Near the preceding - - -	116 3 58	14 50 8 S.		A mass of small stars.
48.	Near the three stars at the root of the Unicorn's tail - - - }	120 36 0	1 16 42 S.		A mass of small stars.
49.	Near ρ Virgo - - -	184 26 58	9 16 9 N.		See Mem. Acad. 1779.
50. 1772.	Above θ Great Dog - - -	102 57 28	7 57 42 S.		{ A mass of small stars below the Unicorn's right thigh.
51. 1774.	{ Below η Great Bear. Near the ear of the Northern Greyhound - }	200 5 48	48 24 24 N.		{ Double. The two atmospheres, whose centres are 4' 35" distant, touch one another, and are bright in the middle. The one is fainter than the other. Resolved into stars by Dr. Herschel.
52.	Below d Cassiopeia - - -	348 39 27	60 22 12 N.		{ Mass of stars, mixed with a nebulosity, according to Dr. H. This cluster appears like a solid ball, consisting of small stars, quite compressed into one blaze of light, with a great number of loose ones surrounding it.
53. 1777.	Near α Berenice's hair - - -	195 30 26	19 22 44 N.		Round, and resolved into stars by Dr. H.
54. 1778.	In Sagittarius - - -	280 12 55	30 44 1 S.	6'	Faint and bright in the centre.
55.	In Sagittarius - - -	291 30 25	31 26 27 S.		A white spot, resolved into stars by Dr. H.
56. 1779.	Near the Milky Way - - -	287 0 1	29 48 14 N.		Faint, and resolved into stars by Dr. H.
57.	Between γ and β Lyra - - -	281 20 8	32 46 3 N.		Round, and consisting of a mottled nebulosity.
58.	In Virgo - - -	186 37 23	13 2 42 N.		Very faint, without any star.
59.	Near the preceding - - -	187 41 38	12 52 36 N.		Very faint, without any star.
60.	In Virgo - - -	188 6 53	12 46 2 N.		Brighter than the two preceding.
61.	In Virgo - - -	182 41 5	5 42 5 N.		Very faint.
62.	In Scorpio - - -	251 48 24	29 45 30 S.		{ Like a comet, with a brilliant centre, surrounded with a faint light. Resolved into stars by Dr. H.
63.	In the Canes Venatici - - -	196 5 30	43 12 37 N.		Very faint.
64. 1780.	In Berenice's hair - - -	191 27 38	22 52 31 N.		Faint.
65.	In the Lion - - -	166 50 54	14 16 8 N.		Faint, but resolved into stars by Dr. H.
66.	Very near the preceding - - -	167 11 39	14 12 21 N.		Very faint, but resolved into stars by Dr. H.
67.	Below the southern claw of the Crab - - - }	129 6 57	12 36 38 N.		{ A mass of stars, with nebulosity. It is a cluster, pretty much compressed, in which Dr. H. has observed 200 stars at once, with a power of 157 in his great reflector.
68.	Below the Crow - - -	186 54 33	25 30 20 S.	2'	Very faint.
69.	Below the left arm of Sagittarius - - - }	274 11 46	32 31 45 S.	2'	Faint, like the nucleus of a small comet.
70.	Near the preceding - - -	277 13 16	32 31 7 S.	2'	Near four telescopic stars.
71.	Between γ and δ Arrow - - -	295 59 9	18 13 0 N.	3' 30"	Very faint, and resolved into stars by Dr. H.
72.	Above the tail of Capricorn - - -	310 20 49	13 20 51 S.	2'	Faint, but resolved into stars by Dr. H.
73.	Near the preceding - - -	311 43 4	13 28 40 S.		{ Three or four small stars, containing a little nebulosity.

STARS.

No. and Year when observed.	Position of the Nebulae.	Right Ascen. in Degrees.	Declination.	Diamet.	General Remarks.
74.	Near η in the string that connects the Fishes	21 14 9	14 39 35 N.		{ Very faint, but resolved into stars by Dr. Herschel.
75.	Between Sagittarius and the head of Capricorn	208 17 24	22 32 23 S.		{ Composed of small stars, with nebulosity. Mechain makes it only nebulous.
76.	In Andromeda's right foot	22 10 47	50 28 48 N.	2'	{ Composed of small stars, with nebulosity. Small and faint.
77.	In the Whale - - -	37 52 33	0 57 43 S.		{ A mass of small stars, containing nebulosity.
78.	In Orion - - -	83 53 35	0 1 23 S.	3'	{ A mass of stars, with two bright nuclei, surrounded with a nebulosity.
79.	Below the Hare - - -	78 49 2	24 42 57 S.		{ A fine nebula, bright in the centre, and a little diffused. Resolved into a mottled nebulosity by Dr. H.
80.	Between γ and δ Scorpio	240 59 48	22 25 13 S.	2'	{ Round and bright in the centre, like a comet.
1781. 81.	Near the ear of the Great Bear	144 27 44	70 7 24 N.		{ A little oval, bright in the centre, and exhibiting a mottled nebulosity to Dr. H.
82.	Near the preceding - - -	144 29 22	70 44 27 N.		{ Faint, and elongated, with a telescopic star at its extremity. It shewed a mottled nebulosity to Dr. H.
83.	Near the Centaur's head	201 8 13	28 42 27 S.		{ Very faint.
84.	In Virgo - - -	183 30 21	14 7 1 N.		{ Bright in the centre, and surrounded with nebulosity.
85.	Above and near Spica - - -	183 35 21	19 24 26 N.		{ Very faint.
86.	In Virgo - - -	183 46 21	14 9 52 N.		{ The same as N ^o 84, and near it.
87.	In Virgo - - -	184 57 6	13 38 1 N.		{ As luminous as the preceding.
88.	In Virgo - - -	185 15 49	15 37 51 N.		{ Very faint, and like N ^o 58.
89.	Near N ^o 87 - - -	186 9 36	13 46 49 N.		{ Very faint.
90.	In Virgo - - -	186 27 0	14 22 50 N.		{ Like the preceding.
91.	Above the preceding	186 37 0	14 57 6 N.		{ Fainter than the preceding.
92.	Between the knee and the left leg of Hercules	257 38 3	43 21 59 N.	5'	{ A beautiful nebula, bright in the centre, and surrounded with great nebulosity. Resolved into stars by Dr. H.
93.	Between the Great Dog and the Ship	113 48 35	23 19 45 S.	8'	{ A mass of small stars.
94.	Above Cor Caroli - - -	190 10 46	42 18 43 N.	2' 30''	{ Bright in the centre, with a diffused nebulosity.
95.	In the Lion, above ι - - -	158 3 5	12 50 21 N.		{ Very faint.
96.	Near the preceding - - -	158 46 20	12 58 9 N.		{ Fainter than the preceding.
97.	Near β Great Bear - - -	165 18 40	56 13 30 S.	2'	{ Very faint. Another near it, and another near γ .
98.	Above N. wing of Virgo	180 50 49	16 8 15 N.		{ Very faint.
99.	On the N. wing of Virgo	181 55 19	15 37 12 N.		{ Brighter than the preceding. Between two stars of the 7th and 8th magnitude.
100.	In the ear of corn in Virgo	182 59 19	16 59 21 N.		{ Like the preceding.
101.	Between the left hand of Bootes and the tail of the Great Bear	208 52 4	55 24 25 N.	7'	{ Very faint. Discovered by Mechain. Mottled nebulosity, according to Dr. H.
102.	Between α Bootes and ι Dragon	- - -	- - -		{ Very faint. Discovered by Mechain.
103.	Between ϵ and δ Cassiopeia	- - -	- - -		{ A mass of stars.

STAR, *Nebulous*, is a luminous point, surrounded with an immense visible atmosphere. Dr. Herschel thinks, that the central point is a star, from its complete resemblance to a star of equal magnitude. Allied to these are planetary nebulae, or circular spaces in the heavens, uniformly luminous, resembling a planetary disc. The light of one of these nebulae, 15" in diameter, was hardly equal to that of a star of the 8th or 9th magnitude. Hence Dr. Herschel supposes, that they can scarcely be bodies like our sun, as a part of the sun's disc, 15" in diameter, would exceed the greatest lustre of the full moon. If, on the other hand, he observes, we should suppose them to be groups or clusters

of stars, at a distance sufficiently great to reduce them to so small an apparent diameter, we shall be at a loss to account for their uniform light, if clusters; or for their circular forms, if mere groups of stars. Perhaps they may be rather allied to nebulous stars; for, should the planetary nebulae, with lucid centres, be an intermediate step between planetary nebulae and nebulous stars, the appearances of these different species, when all the individuals of them are fully examined, might throw a considerable light on the subject. The class of planetary nebulae with centres differs only from the last in having a bright central point. See NEBULOSITY.

STARS.

Catalogue of Two Hundred and Eighty-eight of the Class of Bright Nebulæ, according to the Observations of
Dr. Herschel:—F. signifying following, P. preceding, N. north, and S. south.

Number.	Stars by which the Nebulæ may be found.	Differ. of Right Ascension in Time between the Nebulæ and the Star.		Difference in Declination.		Number.	Stars by which the Nebulæ may be found.	Differ. of Right Ascension in Time between the Nebulæ and the Star.		Difference in Declination.						
		M.	S.	D.	M.			M.	S.	D.	M.					
1.	82 δ Ceti - -	2	17	F.	0	8	N.	58.	19	Eridani - -	5	9	F.	1	22	S.
2.	3 Leonis - -	18	7	P.	1	12	S.	59.	15	α Navis - -	64	18	F.	0	21	N.
3.	34 Sextantis - -	28	55	P.	0	13	S.	60.	19	Eridani - -	6	51	P.	0	16	N.
4.		28	27	P.	0	10	S.	61.	6	Sextantis - -	8	42	P.	0	31	N.
5.	81 Leonis - -	2	42	P.	0	7	N.	62.	55	ζ Ceti - -	0	25	P.	0	37	N.
6.	64 Virginis - -	33	56	F.	0	1	S.	63.	80	Ceti - -	5	12	F.	0	25	S.
7.	49 Leonis - -	126	45	F.	0	40	S.	64.	8	1 ε Eridani - -	15	9	P.	0	2	N.
8.	32 2 / Virginis - -	2	50	F.	0	48	N.	65.	31	Crateris - -	23	30	F.	0	52	N.
9.	10 r Virginis - -	3	12	F.	0	35	S.	66.	12	Hydræ - -	25	2	F.	1	7	S.
10.		33	37	F.	0	4	N.	67.	8	n Corvi - -	37	17	P.	2	10	N.
11.	5 Comæ Berenices	1	30	P.	2	11	S.	68.	53	Virginis - -	12	40	P.	1	4	N.
12.	6 Comæ - -	9	12	F.	0	9	S.	69.			11	4	P.	1	34	N.
13.	69 Leonis - -	7	57	P.	0	2	N.	70.	106	Virginis - -	1	2	F.	0	54	N.
14.	29 γ Virginis - -	0	43	F.	1	23	N.	71.	19	δ Libræ - -	0	3	P.	1	4	N.
15.		3	23	F.	0	58	N.	72.	23	Leonis min.	13	7	F.	0	13	N.
16.		10	34	F.	0	13	N.	73.	13	Can. vena - -	50	17	P.	0	22	S.
17.	} 46 i Leo - - }	15	50	F.	1	32	S.	74.	13	Can. vena - -	43	5	P.	1	11	S.
18.		16	18	F.	1	29	S.	75.			40	35	P.	1	9	S.
19.	11 Comæ - -	10	30	P.	0	46	N.	76.			38	3	P.	0	52	S.
20.	73 n Leonis - -	8	52	F.	1	57	S.	77.			34	15	P.	0	23	N.
21.		25	31	F.	1	49	S.	78.	27	Urfæ - -	7	46	F.	0	4	N.
22.	34 Virginis - -	22	24	P.	0	17	S.	79.			33	52	F.	1	17	N.
23.		18	24	P.	0	19	S.	80.			67	10	F.	0	46	N.
24.	30 ε Virginis - -	1	42	P.	0	5	S.	81.	41	Leonis min.	0	6	P.	1	40	N.
25.	34 Virginis - -	4	45	F.	0	40	S.	82.	14	b Comæ - -	37	40	P.	0	14	S.
26.	52 K. Leonis - -	3	45	P.	2	9	S.	83.	21	g Comæ - -	0	10	F.	1	12	N.
27.	46 i Leonis - -	18	47	F.	0	43	S.	84.			19	34	F.	0	55	N.
28.	34 Virginis - -	19	36	P.	1	8	N.	85.	40	Comæ - -	5	9	F.	0	18	N.
29.	73 n Leonis - -	1	9	P.	0	30	S.	86.	39	Leonis min.	13	14	P.	0	59	N.
30.	31 i d Virginis - -	17	41	P.	0	32	N.	87.	44	Leonis min.	9	30	F.	1	1	N.
31.	31 i d Virginis - -	8	0	P.	0	37	N.	88.			13	30	F.	0	1	N.
32.		5	11	P.	0	28	N.	89.	14	b Comæ - -	8	18	P.	0	55	N.
33.	9 o Virginis - -	3	12	F.	1	39	N.	90.			6	30	P.	1	57	N.
34.	59 e Virginis - -	20	42	F.	0	34	S.	91.	15	c Comæ - -	1	10	F.	0	19	N.
35.	34 Virginis - -	31	42	P.	1	5	N.	92.			9	8	F.	0	19	S.
36.	} 32 2 d Virginis - - }	11	24	P.	0	20	N.	93.	31	Comæ - -	2	56	F.	1	24	N.
37.		11	24	P.	0	20	N.	94.	61	Urfæ - -	0	6	F.	2	17	N.
38.	32 2 d Virginis - -	11	36	P.	0	0	N.	95.			35	0	F.	2	7	N.
39.	51 θ Virginis - -	21	36	P.	0	14	S.	96.	14	Canum - -	5	30	F.	1	12	N.
40.		5	48	P.	0	2	N.	97.			7	58	F.	0	47	N.
41.	28 Virginis - -	9	24	F.	1	2	N.	98.			36	50	F.	0	12	S.
42.	26 χ Virginis - -	30	27	F.	0	8	N.	99.	27	γ Bootes - -	13	46	P.	1	46	S.
43.	49 g Virginis - -	28	6	P.	0	51	S.	100.	41	Ceti - -	13	43	F.	0	48	N.
44.	51 e Ophiuchi - -	7	18	F.	0	0	N.	101.	67		17	19	P.	0	25	N.
45.	43 Ophiuchi - -	6	36	P.	0	4	N.	102.			21	37	F.	0	13	S.
46.		0	54	F.	1	46	N.	103.	14	Delphini - -	16	10	P.	0	3	S.
47.	1 m Aquilæ - -	17	48	F.	0	33	S.	104.	93	↓ Aqua. - -	1	8	F.	0	42	N.
48.	43 d Sagittarius - -	114	6	P.	1	44	N.	105.	47	Ceti - -	26	24	F.	0	37	S.
49.	10 γ Sagittarius - -	2	18	P.	0	23	N.	106.	89	π - -	38	10	F.	1	24	S.
50.	19 δ Sagittarius - -	3	0	F.	0	33	S.	107.	20	Eridani - -	4	3	F.	1	4	S.
51.	22 λ Sagittarius - -	3	12	F.	0	13	S.	108.	111	ξ Piscium - -	34	22	P.	0	1	S.
52.	17 Delphini - -	6	0	F.	2	24	N.	109.	12	Eridani - -	7	17	P.	2	54	N.
53.	66 v Cygni - -	78	6	F.	0	51	S.	110.	9	Ceti - -	44	0	P.	0	47	S.
54.	35 v Andromeda - -	18	36	F.	1	26	S.	111.			43	3	P.	0	6	S.
55.	66 Pegasi - -	17	59	P.	0	2	N.	112.	5	γ Arietis - -	5	48	F.	0	17	S.
56.	} 4 λ Leonis - - }	0	46	F.	1	29	S.	113.	66	4th σ Can. - -	18	22	F.	1	34	N.
57.		0	46	F.	1	29	S.	114.	18	Leonis min.	13	39	P.	0	35	S.

STARS.

Number.	Stars by which the Nebulæ may be found.	Differ. of Right Ascension in Time between the Nebulæ and the Star.		Difference in Declination.		Number.	Stars by which the Nebulæ may be found.	Differ. of Right Ascension in Time between the Nebulæ and the Star.		Difference in Declination.		
		M.	S.	D.	M.			M.	S.	D.	M.	
115.		5	47 P.	1	10 N.	175.	13 Canum - -	46	3 P.	2	28 N.	
116.	} 37 - - -	11	5 F.	1	1 N.	176.	} 8 - - -	16	33 P.	1	26 N.	
117.						177.						
118.	46 Urfæ - -	3	41 P.	1	32 S.	178.		} 20 - - -	7	36 F.	0	12 S.
119.	31 11t d Virginis - -	6	0 P.	0	55 N.	179.			29	9 F.	3	15 N.
120.	30 n Crateri - -	9	0 P.	0	17 N.	180.		40	13 F.	1	11 N.	
121.	13 n Virginis - -	18	15 P.	0	19 S.	181.		17	22 P.	0	2 S.	
122.	57 μ Eridani - -	4	0 P.	0	22 N.	182.	1 Serpentes - -	11	19 P.	0	1 N.	
123.	60 σ Virginis - -	52	27 P.	0	30 S.	183.		8	21 P.	1	15 S.	
124.		39	57 P.	0	3 S.	184.	8 Libræ - -	11	6 F.	0	1 N.	
125.		39	12 P.	1	6 S.	185.	19 λ Bootes - -	47	14 P.	1	20 N.	
126.	108 - - -	0	35 P.	1	15 N.	186.		20	15 P.	1	14 N.	
127.	110 - - -	1	47 P.	0	23 S.	187.		13	24 P.	2	44 N.	
128.		3	37 F.	0	30 S.	188.	38 2d b - -	3	57 F.	0	23 S.	
129.	26 χ - - -	9	46 F.	0	41 S.	189.	24 g - - -	11	32 F.	1	11 S.	
130.		26	35 F.	0	3 S.	190.	} Canum 6 m. - -	80	46 P.	2	32 N.	
131.	14 ε Crateri - -	0	29 F.	1	3 N.	191.			1	26 P.	0	54 N.
132.	26 Hydræ - -	1	44 F.	0	4 N.	192.	3 Lacertæ - -	3	19 F.	0	5 N.	
133.	49 g Virginis - -	16	4 P.	0	18 N.	193.	54 ρ Androm. - -	4	49 F.	0	2 N.	
134.		13	27 P.	0	13 N.	194.	56 Urfæ - -	7	17 F.	0	38 N.	
135.	} 68 ε - - -	32	2 P.	0	11 N.	195.	67 - - -	3	32 P.	0	19 N.	
136.						196.		15	Leo min. - -	32	1 F.	0	24 S.
137.	41 Lyncis - -	3	13 F.	0	8 N.	197.	} 59 2d σ Canum - -	4	29 P.	0	29 N.	
138.	102 ε Hydræ - -	33	45 F.	1	27 N.	198.			0	5 F.	0	17 S.
139.	11 ε Virginis - -	12	1 F.	1	21 S.	199.	63 χ Urfæ - -	0	47 F.	0	4 N.	
140.		39	55 F.	0	31 S.	200.		7	42 F.	0	31 N.	
141.		45	50 F.	1	32 S.	201.	9 - - -	16	27 P.	2	7 N.	
142.	37 - - -	6	35 P.	0	0 N.	202.		22	18 F.	3	1 N.	
143.	43 δ Virginis - -	4	55 F.	2	7 S.	203.	} 3 Canum - -	14	39 P.	1	35 N.	
144.	109 - - -	25	58 P.	0	54 N.	204.			14	0 P.	1	32 S.
145.	} 25 14 P. - -	1	27 N.			205.		9	9 P.	1	32 N.	
146.						206.		3	33 P.	1	6 S.	
147.	43 Ophiuchi - -	8	54 P.	1	17 S.	207.	60 Urfæ - -	46	0 F.	0	9 N.	
148.	24 α Serpentes - -	22	26 P.	1	16 S.	208.	11 Canum - -	5	47 F.	1	58 S.	
149.	40 ε Ophiuchi - -	0	14 F.	1	32 N.	209.	60 Urfæ - -	50	50 F.	1	58 S.	
150.		27	53 F.	0	36 N.	210.	19 λ Bootes - -	110	25 P.	1	48 N.	
151.	71 ε Piscium - -	21	41 F.	1	41 N.	211.	17 * - - -	8	26 P.	1	56 N.	
152.	24 ξ Arietis - -	16	23 P.	0	20 N.	212.	Neb. II. 757 - -	3	27 P.	1	14 S.	
153.	59 2d ν Ceti - -	23	16 P.	0	6 S.	213.	22 Urfæ - -	13	52 P.	3	4 S.	
154.	14 Triang. - -	1	23 F.	0	59 N.	214.	54 Persei - -	9	25 F.	0	46 N.	
155.	32 Eridani - -	7	49 F.	1	1 S.	215.	63 Aurigæ - -	26	43 F.	0	20 S.	
156.	12 q Persei - -	1	41 P.	1	10 S.	216.	55 Urfæ - -	5	33 F.	0	36 N.	
157.	90 ν Piscium - -	28	9 F.	0	13 N.	217.	64 γ Urfæ - -	43	59 P.	0	20 S.	
158.	48 ν Eridani - -	4	32 P.	1	46 S.	218.		21	41 P.	0	37 S.	
159.	20 π Cassiopeia - -	8	30 F.	0	33 N.	219.		20	20 P.	0	35 S.	
160.	20 γ Virginis - -	6	17 P.	2	19 S.	220.	1 Canum - -	6	4 F.	2	45 S.	
161.	6 Comæ - -	12	58 F.	0	55 S.	221.		9	19 P.	3	10 S.	
162.	29 Comæ - -	10	35 F.	0	2 N.	222.		8	31 P.	0	46 S.	
163.	20 Sextantis - -	8	29 P.	0	22 S.	223.	64 γ Urfæ - -	33	32 P.	0	34 S.	
164.	38 Leo min. - -	2	54 P.	0	36 S.	224.		15	28 P.	2	37 N.	
165.	6 Canum - -	15	42 P.	0	25 N.	225.		5	20 P.	2	24 N.	
166.		1	20 P.	0	23 N.	226.		3	46 F.	1	47 N.	
167.	10 n Urfæ - -	13	43 F.	1	30 S.	227.	83 Urfæ - -	20	24 F.	0	27 N.	
168.	34 μ - - -	4	9 P.	0	6 S.	228.		24	34 F.	0	10 N.	
169.	6 Canum - -	16	16 P.	0	53 N.	229.		27	7 F.	0	16 N.	
170.	20 - - -	28	12 F.	1	6 N.	230.	44 Urfæ - -	1	14 F.	0	16 S.	
171.	53 2d ν Bootes - -	49	57 P.	1	10 N.	231.	74 Urfæ - -	1	31 F.	0	28 S.	
172.	31 Leo min. - -	25	2 F.	0	3 S.	232.						
173.		86	19 F.	0	23 N.	233.						
174.	53 ξ Urfæ - -	46	14 F.	0	24 N.	234.						

STARS.

Number.	Stars by which the Nebulæ may be found.	Differ. of Right Ascension in Time between the Nebulæ and the Star.		Difference in Declination.		Number.	Stars by which the Nebulæ may be found.	Differ. of Right Ascension in Time between the Nebulæ and the Star.		Difference in Declination.	
		M.	S.	D.	M.			M.	S.	D.	M.
235.	12 ϵ Draconis -	66	52 P.	2	3 S.	264.		14	18 P.	1	36 N.
236.		59	56 P.	2	13 S.	265.	37 Urfæ - -	16	16 P.	1	5 N.
237.		54	10 P.	0	52 S.	266.		13	35 P.	0	11 S.
238.	69 Urfæ, Hev. -	27	55 P.	0	32 S.	267.	39 Urfæ - -	11	21 F.	0	10 S.
239.		28	10 F.	0	17 S.	268.		12	46 F.	0	4 S.
240.		28	34 F.	0	17 S.	269.		18	1 F.	0	29 N.
241.	19 Hyd. Crat. -	14	43 P.	0	57 S.	270.		35	36 F.	1	42 N.
242.	15 f Urfæ - -	15	40 P.	0	21 S.	271.		35	54 F.	0	55 N.
243.	77 ϵ Urfæ - -	1	47 F.	2	25 N.	272.	Georgium Sidus -	0	53 P.	0	6 N.
244.	39 Urfæ - -	36	44 F.	0	40 N.	273.	A double star -	5	45 F.	0	39 S.
245.		39	27 F.	1	58 N.	274.		10	13 F.	0	24 S.
246.	66 Urfæ - -	29	19 P.	0	20 N.	275.	5 Draconis, Hev. -	1	32 F.	0	12 N.
247.		28	13 P.	2	0 N.	276.		2	45 F.	0	12 N.
248.		7	5 P.	2	52 N.	277.		6	20 F.	0	20 N.
249.	17 Urfæ - -	9	0 P.	3	43 N.	278.		11	5 P.	0	15 S.
250.		4	47 P.	3	17 N.	279.		10	28 P.	1	38 N.
251.	76 Urfæ - -	50	48 P.	2	3 S.	280.	16 ζ Urfæ min. -	51	33 P.	0	3 N.
252.		41	11 P.	0	34 S.	281.	τ Appf. Sculpf. }	1	47 P.	0	27 N.
253.		41	46 P.	0	51 S.		L. C. 95. - }				
254.		1	47 P.	1	8 S.	282.	208 N. Camelop. }	153	15 P.	2	43 S.
255.	69 Urfæ, Hev. -	19	26 F.	1	1 N.		of Bode's Cat. }				
256.		21	33 F.	0	13 N.	283.		113	40 P.	3	4 S.
257.	12 Eridani - -	16	58 F.	1	58 S.	284.		85	18 P.	0	23 S.
258.	47 λ Persei - -	3	41 P.	1	0 N.	285.	24 d Urfæ - -	13	14 F.	1	53 S.
259.	17 Hydræ Crat. -	18	31 F.	0	27 N.	286.		30	0 F.	1	8 S.
260.	23 b Urfæ - -	1	49 P.	0	34 S.	287.	1 λ Draconis -	4	37 P.	1	13 N.
261.	38 of Connoif. -	3	7 F.	1	35 S.	288.	184 Camelop. of }	11	58 P.	2	34 S.
262.	1 λ Draconis -	2	6 P.	2	41 S.		Bode's Cat. }				
263.	4 Draconis - -	22	48 P.	0	23 S.						

A table of nebulae in the southern hemisphere, by La Caille, may be seen in the "Connoissance des Temps" for 1784, p. 270.

STARS, *The Number of*, appears to be vastly great, almost infinite; yet have astronomers long ago ascertained the number of those visible to the eye, which are found much fewer than one might imagine. See *CATALOGUE of the Stars*.

Of the 3000 contained in the *Britannic Catalogue*, there are many only visible through a telescope; nor does a good eye scarcely ever see more than a thousand at the same time in the clearest heaven; the appearance of innumerable more, frequent in clear winter nights, arising from our sight's being deceived by their twinkling, and from our viewing them confusedly, and not reducing them to any order. Yet, for all this, the stars are really almost infinite. See Halley on the Number, Order, and Light of the fixed Stars, *Phil. Trans.* N^o 364, or *Abr.* vol. vi. p. 148.

Riccioli makes no scruple to affirm, in his *New Almagest*, that a man who should say there are above twenty thousand times twenty thousand, would say nothing improbable.

For a good telescope, directed to almost any point of the heavens, discovers numbers that are lost to the naked sight; particularly in the Milky Way, which Dr. Herschel has ascertained to be an assemblage of stars, too remote to be singly seen, but so closely disposed as to give a luminous appearance to that part of the heavens where they are. See *GALAXY*.

In the single constellation of the Pleiades, instead of 6, 7, or 8 stars seen by the best eye, Dr. Hooke, with a telescope 12 feet long, told 78, and with larger glasses many more of different magnitudes. And F. de Rhita, a Capuchin,

affirms, that he has observed above 2000 stars in the single constellation of Orion.

The same author found above 188 in the Pleiades. And Huygens, looking at the star in the middle of Orion's sword, instead of one found it to be twelve. Galileo found 80 in the space of the belt of Orion's sword, 21 in the nebulous star of his head, and above 500 in another part of him, within the compass of one or two degrees space, and more than 40 in the nebulous star *Præsepe*. See *Magnitudes of the Stars, supra*.

If an ordinary telescope, therefore, will, in several parts of the heavens, discover ten times as many stars as are visible to the naked eye, what may not be expected from the improved magnifying powers of modern times?

STARS, *The Changes that have happened in the*, are very considerable; contrary to the opinion of the ancients, who held, that the heavens and heavenly bodies were incapable of any change, the matter of which being permanent and eternal, infinitely exceeding the hardness of diamonds, and not susceptible of any different form. And, in effect, till the time of Aristotle, and even two hundred years afterwards, there had no change been observed. The first was above 120 years before the incarnation; when Hipparchus, discovering a new star to appear, was first induced to make a catalogue of the stars, that posterity might perceive any future changes of the like kind. (See *CATALOGUE*.) The number of stars which are ascertained to be variable, amounts only to 15; while those which are suspected to be variable, amount to 37.

In the year 1572, Cornelius Gemma and Tycho Brahe observed another new star in the constellation Cassiopeia, which

which was, likewise, the occasion of Tycho's making a new catalogue. Its magnitude and brightness, at first, exceeded that of the biggest of our stars, Sirius and Lyra; it even equalled that of Venus when nearest the earth, and was seen in fair day-light. It continued sixteen months; towards the latter end of which, it began to dwindle, and at last, *viz.* March, 1573, totally disappeared, without any change of place in all that time.

Leovicus tells us of another star appearing in the same constellation about the year 945, which resembled that of 1572, and quotes another ancient observation, by which it appears, that a new star was seen about the same place in 1264.

Dr. Keil takes those to have been all the same star: and he conjectures its period to be 150 years; but though it did not appear at the end of this period, this might be owing to its having different degrees of lustre at different periods. Right asc. in 1786, $0^h 13' 0''$. Declin. N. $62^\circ 58'$. Greatest and least magn. 1—0.

Fabricius, in 1596, discovered another new star, called the *stella mira*, or wonderful star, in the neck of the Whale, which has been since found to appear and disappear periodically, seven times in six years, continuing in the greatest lustre for fifteen days together; and is never quite extinguished. Its course and motion are described by Bullialdus, in a treatise printed at Paris in 1667. R. asc. in 1786, $2^h 8' 33''$. Decl. S. $3^\circ 37' 25''$. Greatest and least magn. 2—0. Period, determined by Cassini, 334 days: seen by Mr. Goodricke of the 2d magnitude, August 9th, 1782, and by Mr. Pigott of the 8.9 magn. Dec. 30, 1782.

Dr. Herschel has lately, *viz.* in the years 1777, 1778, 1779, 1780, made several observations on this star, an account of which may be seen in the Phil. Trans. vol. lxx. part ii. art. 21. He makes its period $331^d 10^h 19'$.

The variations of Algol, or β Perseus, were first observed by Montanari. In 1693, Maraldi could not perceive any change in its brightness; but in 1694 he saw its variation from the second to the fourth magnitude. Its period was first discovered by Mr. Goodricke to be $2^d 20^h 48' 56''$. He found that its brightness, at its minimum, is different in different periods; and Pigott perceived, that, at its maximum of brightness, it is sometimes more luminous than α Persei, and at other times less brilliant. R. asc. 1786, $2^h 54' 19''$. Decl. N. $40^\circ 6' 55''$. Greatest and least magn. 2—4.

The 420th star in Mayer's Catalogue, situated in the Lion, was found to be variable by M. Koch, being in February, 1782, of the seventh magnitude; in April, 1783, of the ninth; and in April, 1784, of the tenth. Mr. Pigott could not see it, and it must therefore have disappeared. R. asc. 1786, $9^h 36' 5''$. Decl. N. $12^\circ 25' 0''$. Greatest and least magn. 6—0.

Star in Hydra, as far east of π as ψ is west of γ , the 30th Hydra of Hevelius, and probably the 1st of the Balance, according to Flamsteed, was discovered to be variable, in 1784, by Maraldi; and he made its period two years. According to Pigott, it is of the fourth magnitude at its full brightness, and for a fortnight suffers no perceptible change. It takes about six months to increase from the tenth to the fourth magnitude, and about the same time to return to the tenth; so that it may be regarded as invisible to the naked eye during six months. R. asc. 1786, $13^h 18' 4''$. Decl. S. $22^\circ 9' 38''$. Greatest and least magn. 4—0. Period 494 days.

In the year 1604, 17th October, Kepler, and several of his friends, saw a new star near the heel of the right foot of Serpentarius, particularly bright and sparkling; and took notice, that it was every moment changing into some of the colours of the rainbow, except when it was near the horizon, at which time it was generally white. It surpassed

Jupiter in magnitude, but was easily distinguished from it by the steady light of that planet. It began to diminish, and ceased to be visible, October 18th, 1605, and has not been seen since that time; though Mr. Pigott has examined that part of the heavens with great care since the year 1782. R. asc. $17^h 18' 0''$. Decl. S. $21^\circ 10' 30''$. Greatest and least magn. 1—0.

Simon Marius discovered another in Andromeda's girdle, in 1612 and 1613; though Bullialdus says, it had been seen before in the 15th century.

The variations and period of β Lyrae were discovered by Mr. Goodricke. R. asc. $18^h 42' 11''$. Decl. N. $33^\circ 7' 46''$. Greatest and least magn. 3—4.5. Period, not accurately ascertained, $6^d 9^h$.

The new star discovered by Don Anthelme in the Swan's head, on the 20th of June, 1670, soon reached the third magnitude, and, after several variations, disappeared in 1672. It was observed of the sixth magnitude, by Hevelius, in the years 1671, 1672; but since that time has not been seen, though Mr. Pigott must have detected it, if it had been of the tenth or eleventh magnitude. R. asc. $19^h 38' 58''$. Decl. N. $26^\circ 48' 30''$. Greatest and least magn. 3—0.

The star α Antinoi was discovered to be variable by Mr. Pigott, who also determined its period. It continues 40^h at its greatest brightness, 30^h at its least, 66^h on its decrease, and 36^h on its increase. R. asc. $19^h 41' 34''$. Decl. N. $0^\circ 28' 14''$. Greatest and least magn. 3.4—5. Period $7^d 4^h 15'$.

The star χ in the Swan's neck was discovered to be variable by Kirch, in 1686. Maraldi, Cassini, and M. le Gentil, make its period 405 days; whence Pigott concludes that its period is variable, who states that it continues a fortnight at its full brightness. It takes about $3\frac{1}{2}$ months to increase from the eleventh magnitude to its maximum brightness, and to decrease to the eleventh again; so that it may be regarded as invisible for six months. At its greatest lustre, it is sometimes of the fifth, and, at other times, of the seventh magnitude. R. asc. $19^h 42' 21''$. Decl. N. $32^\circ 22' 58''$. Greatest and least magn. 5—0. Period $396^d 21^h$.

The changeable star near γ in the Swan's breast was observed by William Janfenius and Kepler in 1600: it became, in time, so small as to be thought to have entirely disappeared, until the years 1657, 1658, and 1659, when it recovered its former lustre and magnitude; but it soon decayed. Pigott concludes, from the observations of the 17th century, that it continues about five years at its full brightness; that its lustre decreases rapidly during two years; that it is invisible to the naked eye during four years; and that it increases slowly during seven years. At the end of the year 1663, it was at its minimum brightness. From November, 1781, to 1786, Pigott always saw it of the sixth magnitude; though he suspects, that in 1785, 1786, it had rather decreased. R. asc. $20^h 9' 54''$. Decl. N. $37^\circ 22' 37''$. Greatest and least magn. 3—0. Period 18 years.

The variation and period of δ Cephei were discovered by Mr. Goodricke, and the period has been confirmed by Mr. Pigott's observations. Its variations are not easily perceptible, unless at its minimum and maximum brightness. R. asc. $22^h 21' 0''$. Decl. N. $57^\circ 20' 0''$. Greatest and least magn. 4.3—4.5. Period $5^d 8^h 37\frac{1}{2}'$.

The variation and period of the star β or α Hercules were discovered by Dr. Herschel, by comparing it with α Ophiuchi. R. asc. $17^h 4' 54''$. Decl. N. $14^\circ 38'$. Period of variation $60\frac{2}{3}$ days.

The period and variations of a star in Sobieski's shield, having nearly the same right ascension as the star l , and situated

situated about a degree farther south, were discovered by Mr. Pigott, who has given the result of his observations in a table. R. asc. in 1796, $18^{\text{h}} 36' 38''$. Decl. S. $5^{\circ} 56'$. Greatest and least magn. 5—7.8. Period 62 days.

The star in the Northern Crown, ranked of the sixth magnitude by Bayer, but omitted in Flamsteed's Catalogue, was suspected by Mr. Pigott, in 1783, to be variable; and his suspicions were confirmed in the spring of 1795, when it became invisible. He saw it on the 20th of June in this year, of the 9.10th magnitude; and in six weeks afterwards, it attained its full brightness; and on the 11th of August, 1795, it was of the 6.7th magnitude, and so continued for about three weeks. In $3\frac{1}{2}$ weeks it decreased to the 9.10th magnitude, and a few days afterwards it disappeared. In April, 1796, it re-appeared; and on the 7th of May it reached the 9.10th magnitude, increasing as it had done on the 20th of June, 1795. At its maximum brightness, it exhibited great unsteadiness. It then increased, as before, till it reached the 7.8th magnitude; wavering between these two magnitudes till August, 1797. R. asc. in 1796, $15^{\text{h}} 40' 11''$. Decl. N. $28^{\circ} 49' 30''$. Greatest and least magn. 6.7—0. Period $10\frac{1}{2}$ months.

The stars that are supposed to be variable are the following: viz. Hevelius's δ Cassiopeæ; R. asc. $0^{\text{h}} 23' 16''$. Decl. N. $60^{\circ} 50'$. Greatest and least magn. 7—0:—46 or ξ Andromedæ, suspected to be different stars; R. asc. $1^{\text{h}} 9' 46''$. Decl. N. $44^{\circ} 24'$. Greatest and least magn. 4.5—5.6:—Flamsteed's 50 or ν Andromedæ; R. asc. $1^{\text{h}} 24' 16''$. Decl. N. $40^{\circ} 20' 15''$. Greatest and least magn. 4.5—0:—Hevelius's 41 Andromedæ, probably the same with Tycho's Andromedæ; also, Flamsteed's 50, of the 4.5th magnitude; Flamsteed's τ , of the fifth magnitude; Flamsteed's 49 and 52, and Hevelius's 41, all three of the same brightness, are of the 5.6th magnitude. A star between Hevelius's 41 and Flamsteed's 52 is rather less than the sixth magnitude:—Tycho's 20 Ceti, probably χ in the Whale's belly, of the 4.5th magnitude, and of the same brightness as the three \downarrow Aquarii, which disappeared in the time of Hevelius; R. asc. $1^{\text{h}} 39'$. Decl. S. $13^{\circ} 20'$. Greatest and least magn. 5—0:—Flamsteed's 55 Andromedæ, marked nebulous in his catalogue, observed to be a star of the sixth magnitude; R. asc. $1^{\text{h}} 40' 30''$. Decl. N. $39^{\circ} 40' 3''$. Greatest and least magn. 6—0:— σ or the 17th Eridani, according to Ptolemy and Ulugh Beigh, could not be seen by Flamsteed in 1691 and 1692; but in 1782, 1783, and 1784, Mr. Pigott observed in this place a star of the seventh magnitude, without any variation of brightness; R. asc. $2^{\text{h}} 42'$. Decl. S. $9^{\circ} 40'$. Greatest and least magn. 4—0:—Flamsteed's 41 Tauri, the 26th of Ulugh Beigh, and the 43d of Tycho, suspected by Cassini to be new and variable, was seen by Ulugh Beigh and Tycho, and found by Mr. Pigott, in 1784 and 1785, to be of the fifth magnitude, as Hevelius made it, but of the sixth magnitude, according to Flamsteed; R. asc. $3^{\text{h}} 53' 27''$. Decl. N. $27^{\circ} 0' 39''$. Greatest and least magn. 5—8:—The star $2^{\circ} 15'$ N. of 53 Eridani, was believed by Cassini to be a new star, and was not visible in 1664; but in 1784, Mr. Pigott observed it to be less than ω and d , brighter than Λ , and equal to \downarrow Eridani; R. asc. $4^{\text{h}} 29'$. Decl. S. $12^{\circ} 30'$. Greatest and least magn. 4—0:—Flamsteed's 47 Eridani was also supposed by Cassini to be a new one; but in 1784 it appeared to Mr. Pigott less than 46 Eridani. R. asc. $4^{\text{h}} 23' 54''$. Decl. S. $8^{\circ} 41' 40''$. Greatest and least magn. 4—0:—The star γ of the Great Dog is marked by Tycho, Bayer, Hevelius, and Flamsteed, as of the third magnitude: invisible in 1670, according to Maraldi and Montanari, but

in 1692 and 1693, it appeared of the fourth magnitude; observed by Mr. Pigott frequently since 1782, without the least variation; always of the fourth magnitude, a little brighter than θ , and decidedly brighter than ι ; made by La Caille of the fourth magnitude. R. asc. $6^{\text{h}} 54' 5''$. Decl. S. $15^{\circ} 19' 36''$. Greatest and least magn. 3—0:—Pollux, or β Gemini, was undoubtedly brighter in 1783, 1784, and 1785, than Castor; both made by Hevelius of the second magnitude: Flamsteed makes Castor of the first, and Pollux of the second magnitude: La Caille makes Castor of the 1.2d, and Pollux of the 2.3d magnitude: and Bradley makes them both of the first magnitude. R. asc. $7^{\text{h}} 32' 11''$. Decl. N. $28^{\circ} 31' 38''$. Greatest and least magn. 1—3:—The star ξ Leonis is marked by Tycho, Bayer, Flamsteed, Mayer, and Bradley, of the fourth magnitude; could scarcely be seen by Maraldi and Montanari in 1693; always seen in 1783, 1784, and 1785, of the fifth magnitude, less than Λ and π , and perhaps rather brighter than b and ω Leonis. R. asc. $9^{\text{h}} 20' 4''$. Decl. N. $12^{\circ} 14' 23''$. Greatest and least magn. 5.6—0:—The star \downarrow Leonis is said to have disappeared in 1667, when it was seen by Montanari; observed by Maraldi in 1691, when it was very small; from 1784 to 1786, always seen by Pigott of the 5.6th magnitude, less than ω , and brighter than i , Flamsteed's 46th; made by Hevelius of the fifth, and by Flamsteed of the sixth magnitude. R. asc. $9^{\text{h}} 32' 3''$. Decl. N. $14^{\circ} 59' 36''$. Greatest and least magn. 5.6—0:—The star 25 Leonis was found by Mr. Pigott to be missing in 1783, nor could he see it in 1784 and 1785. R. asc. $9^{\text{h}} 46' 8''$. Decl. N. $12^{\circ} 20' 36''$. Greatest and least magn. 6.7—0:—Bayer's i Leonis and Tycho's 16 Leonis was invisible in 1709; and could not be seen by Pigott in 1785; nor is it the i Leonis of other catalogues. R. asc. $9^{\text{h}} 52' 30''$. Decl. N. $15^{\circ} 30'$. Greatest and least magn. 6—0:— δ of the Great Bear is marked of the second magnitude by Tycho and the prince of Hesse; but Hevelius, La Caille, and Bradley, mark it of the third. From 1783 to 1786 it appeared to Pigott as a bright fourth magnitude, rather less than ι , equal to α , and rather brighter than α Draconis: Flamsteed makes it of the 2.3d magnitude. R. asc. $12^{\text{h}} 4' 45''$. Decl. N. $58^{\circ} 13' 24''$. Greatest and least magn. 2—4:—The star η Virginis, though not in the charts of Bayer, was observed by Ricciolus; was not seen by Flamsteed on the 27th of January, 1680, though he must have observed it on the 12th of May 1677, and some years afterwards, as it is in his catalogue; observed frequently in 1784 and 1785, by Pigott; but it always appeared of the sixth magnitude, as it is marked by Flamsteed; by Bradley it is of the fifth magnitude. R. asc. $12^{\text{h}} 7' 43''$. Decl. N. $0^{\circ} 24' 16''$. Greatest and least magn. 6—0:—Bayer's star of the sixth magnitude, 1° S. of γ Virginis, could not be seen by Maraldi, and looked for in vain by Pigott in May, 1785. R. asc. $12^{\text{h}} 53'$. Decl. S. 10° . Greatest and least magn. 6—0:—The star in the Virgin's northern thigh is marked by Ricciolus as of the 6th magnitude; could not be seen by Maraldi in 1709, nor by Pigott in 1785. R. asc. $13^{\circ} 29' +$. Decl. S. $0^{\circ} 30'$. Greatest and least magn. 6—0:— η 1 or η 2 Virginis, the first supposed by Pigott to be missing in 1785; the other is of the 6.7th magnitude. R. asc. $13^{\text{h}} 43' 43''$. Decl. N. $2^{\circ} 5' 50''$. Greatest and least magn. 6—0:—The star α Draconis is at present only of the 4th magnitude, though Hevelius, Flamsteed, and Bradley, mark it of the third; Pigott and Herschel think it to be variable; La Caille marks it of the third magnitude. R. asc. $13^{\text{h}} 58' 36''$. Decl. N. $65^{\circ} 24' 8''$. Greatest and least magn. 2—4:—Bayer's star in the Well Scales of Libra, could not be found by Maraldi, nor by Pigott in 1784 and 1785.

R. asc. $14^{\circ} 53' 30''$. Decl. S. $13^{\circ} 26'$. Greatest and least magn. 4—7:—Ptolemy's and Ulugh Beigh's ν 6 of the unformed stars in Libra, is marked of the fourth magnitude, and nevertheless does not appear in any modern catalogue; in 1785, Mr. Pigott often observed a star of the seventh magnitude very near its place, rather less than Flamsteed's 41. R. asc. $15^{\text{h}} 29' +$. Decl. S. $20^{\circ} 30'$. Greatest and least magn. 4—7:—The star κ Libræ is marked by Tycho and Bayer as of the fourth magnitude; Hevelius says that it had disappeared: in the years 1783, 1784, and 1785, Pigott always found it of the fifth magnitude; but Flamsteed marks it of the fourth. R. asc. $15^{\text{h}} 29' 39''$. Decl. S. $19^{\circ} 58' 27''$. Greatest and least magn. 4—5:—Tycho's 11 Libræ could not be found by Hevelius and Pigott; the latter thinks that it never existed, and that it is the κ , with an error of 2° in longitude. R. asc. $15^{\text{h}} 37' 30''$. Decl. S. $19^{\circ} 30'$. Greatest and least magn. 4—0:—The star 33 Serpentis was found to be missing in 1784 and 1785, by Pigott. R. asc. $15^{\text{h}} 38'$. Decl. N. $17^{\circ} 14'$. Greatest and least magn. 6—0:—Bayer's star, near ϵ of the Great Bear, could not be seen by Cassini; nor could Pigott find any star near the ϵ brighter than the 7.8th magnitude. R. asc. $16^{\text{h}} 15'$. Decl. N. $82^{\circ} 45'$. Greatest and least magn. 6—0:—The star ρ , or Ptolemy's and Ulugh Beigh's 14th of Ophiuchus, or Flamsteed's 36th, is said to have disappeared before 1695; could not be found by Hevelius; but Pigott found it in 1784 and 1785 of the 4.5th magnitude, much brighter than 39, rather brighter than 51 and 58, and less than 44. R. asc. $17^{\text{h}} 2' 14''$. Decl. S. $26^{\circ} 15' 37''$. Greatest and least magn. 4—0:—Ptolemy's 13th Ophiuchi. R. asc. $17^{\text{h}} 18' +$. Decl. S. $20^{\circ} 35'$. Greatest and least magn. 4—0:—Ptolemy's 18th Ophiuchi. R. asc. $17^{\text{h}} 22'$. Decl. S. $24^{\circ} 10'$. Greatest and least magn. 5—0. These two last-mentioned stars seem to have disappeared; however, Mr. Pigott thinks that the 13th Ophiuchi is Flamsteed's 40th, and that the 18th Ophiuchi should be marked with north instead of south latitude, which would make it coincide nearly with Flamsteed's 58th:—The star σ Sagittarii is thought by Dr. Herschel and Mr. Pigott to be variable; in 1783, 1784, and 1785, he observed it to be of the 2.8th magnitude, and brighter than π Sagittarii. Hevelius makes it of the fourth, and La Caille of the 2.3d magnitude. R. asc. $18^{\text{h}} 42'$. Decl. S. $26^{\circ} 32' 34''$. Greatest and least magn. 2—4:—The star θ Serpentis was observed by Tycho, Bayer, Hevelius, and Flamsteed, to be of the third magnitude; according to Montanari, it was of the fifth; it was frequently observed in 1783, 1784, and 1785, by Pigott, without any perceptible change of lustre, always of the fourth magnitude, less than δ Aquilæ and ρ Ophiuchi; La Caille makes it of the 4.3d magnitude. R. asc. $18^{\text{h}} 45' 35''$. Decl. N. $3^{\circ} 56' 36''$. Greatest and least magn. 4—5:—Tycho's 27 Capricorni could not be seen by Hevelius nor by Pigott. R. asc. $21^{\text{h}} 41' 0''$. Decl. S. $14^{\circ} 28' 0''$. Greatest and least magn. 6—0:—Tycho's 22 Andromedæ, at the end of the chain, was, as Cassini observes, so small, that it could scarcely be seen; Pigott could find no star in its place near the two π Cygni, in 1784 and 1785. R. asc. $21^{\text{h}} 43' 30''$. Decl. N. $49^{\circ} 15'$. Greatest and least magn. 4—0:—Tycho's 19th Aquarii was marked as missing by Hevelius, nor could Flamsteed see it with his naked eye; Pigott is confident that it is the same with Flamsteed's 56th, marked f by Bayer, from which it is only $1\frac{1}{2}^{\circ}$ distant. R. asc. $22^{\text{h}} 25'$. Decl. S. $15^{\circ} 55' 0''$. Greatest and least magn. 6—0:—The star σ Andromedæ, according to Pigott, less than σ Cephei, equal to ζ Cassiopeiæ, or perhaps brighter than it, and brighter than λ , κ , or ι Andromedæ. R. asc.

$22^{\text{h}} 52' 6''$. Decl. N. $41^{\circ} 10' 45''$. Greatest and least magn. 4—6:—La Caille's 483 Aquarii was found by Pigott missing in 1778, nor could he see it in 1783 or 1784. R. asc. $22^{\text{h}} 55' 40''$. Decl. S. $8^{\circ} 50' 45''$.

The following 13 stars are ranked by Dr. Herschel among those that are lost, or have undergone some great change; viz. 80 and 81 Hercules; 71 Hercules; 55 Hercules; 56 Cancer; 19 Perseus; 108 Pices; 73 and 74 Cancer; 8 Hydræ; 26 Cancer; 62 Orion; 34 Berenice's Hair; and 19 Berenice's Hair. The following are reckoned by Dr. Herschel among those that have undergone a change of magnitude since the time of Flamsteed: viz. α Draconis, α Ceti, ζ Serpentis, η in the Swan, the 2 of the Great Bear, ν Bootes, ι Dolphin, β Triangle, γ Eagle, σ Sagittarius, δ of the Great Dog, κ Serpent, κ Serpentarius, β of the Little Horse, δ Dolphin, ϵ Bootes, δ in the Arrow, δ in the Great Bear, α Great Bear, 1st and 2d Hydræ, γ Lyræ, 31st and 34th of the Dragon, 44 Cancer, 96 Tauri, 62 Aries, 12 and 14 Lynx, 38 Perseus, θ Perseus, δ Unicorn, 23 Gemini, 26 Orion, and ξ Lion. The following are marked by Dr. Herschel among the stars that have recently become visible; viz. a star in the end of the Lizard's tail, of the 4.5th magnitude; the star of the eighth magnitude following τ Perseus, probably new; a star near the head of Cepheus, not given by Flamsteed; a considerable star in a direction from the 68th to the 61st Gemini, not in Flamsteed's catalogue; a star of considerable brightness, preceding the first of the Little Horse, not given by Flamsteed; a considerable star, following the first of the Sextant, and another following the 7th, not in Flamsteed's catalogue; a remarkable star between β and δ Hydra, not given by Flamsteed; a star nearly $1^{\circ} 30'$ N. following δ Hercules, in the direction of δ and ν , and of the 4.5th magnitude, not given by Flamsteed; a star of the 6th magnitude, about 3° S. preceding γ Bootes, and another of the same size, preceding λ , not observed by Flamsteed. Phil. Trans. for 1783, vol. lxxiii. p. 247, &c.

From the old catalogues, it is certain that many of the ancient stars are not now visible: this has been particularly remarked with regard to the Pleiades: and it is equally certain, as we have now shewn, that some have become visible.

M. Montanari, in his letter to the Royal Society in 1670, observes, that there are now wanting in the heavens two stars of the second magnitude, in the stern of the ship Argo and its yard, which had been seen till the year 1664. When they first disappeared is not known; but he assures us there was not the least glimpse of them in 1668. He adds he has observed many more changes in the fixed stars, even to the number of a hundred.

Many other changes in the stars have been taken notice of by Cassini, Maraldi, and other observers. See Gregory's Astr. lib. ii. prop. 30, and the preceding part of this article.

As none of these stars could ever be perceived to have tails, it is plain they could not be comets; especially as they had no parallax, even when largest and brightest. It is not improbable that the periodical stars have vast clusters of dark spots, and very slow rotations on their axes, by which means they must disappear when the side covered with spots is turned towards us. And as for those which break out on a sudden with such lustre, these may, perhaps, be suns whose fuel is almost spent, and again supplied by some of their comets falling upon them, and occasioning an uncommon blaze and splendour for some time; which has been conjectured to be one use of the cometary part of any system.

M. Maupertuis, in his Dissertation on the Figures of the Celestial

Celestial Bodies (p. 61—63.), is of opinion, that some stars, by their prodigious swift rotation on their axes, may not only assume the figures of oblate spheroids, but that by the great centrifugal force arising from such rotations, they may become of the figures of mill-stones, or be reduced to flat circular planes, so thin, as to be quite invisible when their edges are turned towards us, as Saturn's ring is in such position. But when very eccentric planets or comets go round any flat star in orbits much inclined to its equator, the attraction of the planets or comets in their perihelions must alter the inclination of the axes of that star; on which account it will appear more or less large and luminous, as its broad side is more or less turned towards us. And thus he imagines we may account for the apparent changes of magnitude and lustre of those stars, and likewise for their appearing and disappearing.

Hevelius (Cometograph. p. 380.) apprehends, that the sun and stars are surrounded with atmospheres, and that, whirling round their axes with great rapidity, they throw off great quantities of matter into those atmospheres, and thereby cause great changes in them; and that thus it may come to pass, that a star, which when its atmosphere is clear, shines out with great lustre, may at another time, when it is full of clouds and thick vapours, appear greatly diminished in brightness and magnitude, or even become quite invisible.

The periodical variation in the light of the stars has also been ascribed to the interposition of the planets which circulate around them; but it is by no means probable, that these planets, even if they do exist, are sufficiently large to obstruct any large portion of their light. Even when seen from the earth, the light of our own sun is not sensibly impaired, when Mercury and Venus are passing over his disc.

The ingenious Mr. Pigott has ventured a step farther than any of his predecessors in this branch of astronomy. In his investigation of the phenomena exhibited by the variable star of Sobieski's shield, the periodical changes of which are affected by very singular anomalies, he supposes, that the greater part of its disc is unenlightened; and that a few luminous spots, placed at certain intervals, produce, by the rotation of the star, all the variations which have been observed. Mr. Pigott supposes, that the body of the stars is dark and solid; that their rotation on their axes is regular; and that the surrounding medium is occasionally generating and absorbing its luminous particles, by a process similar to what Dr. Herschel supposes is going on in the atmosphere of the sun. He imagines, that these luminous particles are sparingly dispersed in the atmosphere of the variable star of Sobieski, from the circumstance of its diminishing even to the ninth magnitude; and as the duration of its full lustre continues only about $9\frac{1}{2}$ days, while it performs a complete rotation in 62 days, he considers the luminous spots to be somewhat circular, and of no great extent. Since this small portion of light may naturally be supposed to diminish and finally disappear, Mr. Pigott imagines, that this may have been the cause of the disappearance of the new stars of 1572 and 1604. Hence he concludes, that there are others which have never shewn a glimpse of brightness; and that there are "primary invisible bodies, or unenlightened stars, that have ever remained in eternal darkness." Following out this notion, Mr. Pigott conceives, that clusters of these dark bodies may be found, and by intercepting "all more distant rays," may appear like dark spaces in the heavens, similar to what has been observed in the southern hemisphere.

STARS, *As for the Nature of the fixed,* their immense distance leaves us greatly at a loss about it. What we can gather for certain from their phenomena is as follows:

1. That the fixed stars are greater than our earth: be-

cause, if that was not the case, they could not be visible at such an immense distance.

2. The fixed stars are farther distant from the earth than the farthest of the planets. For we frequently find the fixed stars hid behind the most distant of the planets: and besides, they are supposed to have no parallax, which the planets have.

3. The fixed stars shine with their own light; for they are much farther from the sun than the remotest planet, and appear much smaller; but since, notwithstanding this, they are found to shine much brighter than such planet, it is evident they cannot borrow their light from the same source as that does, *viz.* the sun; but since we know of no other luminous body beside the sun, whence they might derive their light, it follows, that they shine with their own native light.

Besides, it is known, that the more a telescope magnifies, the less is the aperture through which the star is seen; and, consequently, the fewer rays it admits into the eye. Now since the stars appear less in a telescope which magnifies two hundred times, than they do to the naked eye, inasmuch that they seem to be only indivisible points, it proves at once that the stars are at immense distances from us, and that they shine by their own proper light. If they shone by borrowed light, they would be as invisible without telescopes as the satellites of Jupiter are; for these satellites appear bigger, when viewed with a good telescope, than the largest fixed stars do. Hence,

1. We deduce, that the fixed stars are so many suns; for they have all the characters of suns.

2. That, in all probability, the stars are not smaller than our sun.

3. That it is highly probable, that each star is the centre of a system, and has planets or earths revolving round it, in the same manner as round our sun, *i. e.* it has opaque bodies illuminated, warmed, and cherished by its light. As we have incomparably more light from the moon than from all the stars together, it is absurd to imagine that the stars were made for no other purpose than to cast a faint light upon the earth; especially since many more require the assistance of a good telescope to find them out than are visible without that instrument. Our sun is surrounded by a system of planets and comets, all which would be invisible from the nearest fixed star; and from what we already know of the immense distance of the stars, it is easy to prove, that the sun, seen from such a distance, would appear no bigger than a star of the first magnitude.

From all this it is highly probable, that each star is a sun to a system of worlds moving round it, though unseen by us; especially as the doctrine of a plurality of worlds is rational, and greatly manifests the power, wisdom, and goodness of the great Creator.

How immense, then, does the universe appear! Indeed, it must either be infinite, or infinitely near it.

Kepler, it is true, denies that each star can have its system of planets as our's has; and takes them all to be fixed in the same surface or sphere; urging, that were one twice or thrice as remote as another, it would appear twice or thrice as small, supposing their real magnitudes equal; whereas there is no difference in their apparent magnitudes, justly observed, at all. But to this we oppose, that Huygens has not only shewn that fires and flames are visible at distances where other bodies, comprehended under equal angles, disappear; but it should likewise seem, that the optic theorem about the apparent diameters of objects, being reciprocally proportional to their distances from the eye, does only hold while the diameter of the object has some sensible ratio to its distance.

As for periodical stars, &c. see *Changes, &c. of STARS, supra.*

STARS,

STARS, *Motion of the.* The fixed stars have two kinds of apparent motion; one called the *first, common, or diurnal* motion, arising from the earth's motion round its axis: by this they seem to be carried along with the sphere, or firmament, (in which they appear fixed,) round the earth, from east to west, in the space of twenty-four hours.

The other, called the *second, or proper* motion, is that by which they appear to go backwards from west to east, round the poles of the ecliptic, with such slowness, as not to describe above a degree of their circle in the space of 72 years, or 50 seconds in a year.

This apparent motion is owing to the recession of the equinoctial points, which is 50 seconds of a degree in a year backward, or contrary to the order of the signs of the zodiac.

Some have imagined, but it is unknown on what grounds, that when they are got round to the points whence they first departed, nature will have finished her course, and the stars having performed their career, the heavens will remain at rest; unless the Being, who first gave them motion, appoint them to begin another circuit.

On the footing of this calculation, the world should last about 30,000 years, according to Ptolemy; 25,816, according to Tycho; 25,920, according to Riccioli; and 24,800, according to Cassini.

In consequence of this second motion, the longitude of the stars will be always increasing.

Thus, *e. gr.* the longitude of Cor Leonis was found by Ptolemy, A.D. 138, to be $2^{\circ} 30'$; in 1115, it was observed by the Persians to be $17^{\circ} 30'$; in 1364, by Alphonsus, $20^{\circ} 40'$; in 1586, by the prince of Hesse, $24^{\circ} 11'$; in 1601, by Tycho, $24^{\circ} 17'$; and in 1690, by Mr. Flamsteed, $25^{\circ} 31' 20''$; whence the proper motion of the stars, according to the order of the signs in circles parallel to the ecliptic, is easily inferred.

It was Hipparchus who first suspected this motion, upon comparing the observations of Timocharis and Arilyllus with his own. Ptolemy, who lived three centuries after Hipparchus, demonstrated the same by undeniable arguments.

Tycho Brahe makes the increase of longitude in a century $1^{\circ} 25'$; Copernicus, $1^{\circ} 23' 40'' 12'''$; Flamsteed and Riccioli, $1^{\circ} 23' 20''$; Bullialdus, $1^{\circ} 24' 54''$; Hevelius, $1^{\circ} 24' 46'' 50'''$; whence, with Flamsteed, the annual increase of the longitudes of the fixed stars may be well fixed at $50''$.

From these data, the increase of the longitude of a star for any given time is easily had; and hence the longitude of a star for any given year being given, its longitude for any other year is readily found: *e. gr.* the longitude of Sirius, in Mr. Flamsteed's tables, for the year 1690, being $9^{\circ} 49' 1''$; its longitude for the year 1724 is found by multiplying the interval of time, *viz.* 34 years, by $50''$; the product $1700''$, or $28' 20''$, added to the given longitude, will give the longitude required, $10^{\circ} 17' 21''$. By means of this correction, applied as the case requires, the longitudes of the stars, transcribed from any tables, may be adapted to the present or any given time.

The principal phenomena of the fixed stars, arising from their common and proper motion, besides their longitude, are their altitudes, right ascensions, declinations, occultations, culminations, risings, and settings. See ALTITUDE, ASCENSION, DECLINATION, and OCCULTATION.

Some have supposed that the latitudes of the stars are invariable; but this supposition is founded on two assumptions, which are both controverted among astronomers; one is, that the orbit of the earth continues unalterably in the same plane, and consequently that the ecliptic is invariable, the contrary of which is now very generally allowed. See ECLIPTIC.

The other assumption is, that the stars are so fixed as

to keep their places immoveably. Ptolemy, Tycho, and others, comparing the observations of ancient astronomers with their own, have adopted this opinion. But from the result of the comparison of our best modern observations, with such as were formerly made with any tolerable degree of exactness, there appears to have been a real change in the position of some of the fixed stars, with respect to each other; and several stars of the first magnitude have already been observed, and others suspected to have a proper motion of their own.

Dr. Halley (Phil. Transf. N^o 355, or Jones's Abr. vol. iv. p. 225.) has observed, that the Bull's eye, Sirius, and Arcturus, are now found to be about half a degree more southerly than the ancients reckoned them: that this difference cannot arise from the errors of the transcribers, because the declination of the stars, set down by Ptolemy, as observed by Timocharis, Hipparchus, and himself, shew their latitudes given by him are such as those authors intended; and it is scarcely to be believed, that those three observers could be deceived in so plain a matter. To this he adds, that the bright star in the shoulder of Orion has, in Ptolemy, almost a whole degree more southerly latitude than at present: that an ancient observation, made A.D. 509, at Athens, as Bullialdus supposes, of an appulse of the moon to the Bull's eye, shews that star to have had less latitude at that time than it now has; that as to Sirius, it appears by Tycho's observations, that he found him $4\frac{1}{2}$ more northerly than he is at this time. All these observations, compared together, seem to favour an opinion, that some of the stars have a proper motion of their own, which changes their places in the sphere of heaven: this change of place, as Dr. Halley observes, may shew itself in so long a time as 1800 years, though it be entirely imperceptible in the space of one single century; and it is likely to be soonest discovered in such stars as those just now mentioned, because they are all of the first magnitude, and may, therefore, probably be some of the nearest to our solar system. Arcturus, in particular, affords a strong proof of this: for if its present declination be compared with its place as determined either by Tycho or Flamsteed, the difference will be found to be much greater than what can be suspected to arise from the uncertainty of their observations. See ARCTURUS, and Mr. Hornsby's Inquiry into the Quantity and Direction of the proper Motion of Arcturus, Phil. Transf. vol. lxxiii. part i. p. 93, &c.

Upon the whole, we have reason to conclude, that there is not, strictly speaking, any *fixed* star in the heavens; and to admit the general motion of all the starry systems, and consequently of the solar one among the rest.

For an account of Dr. Bradley's observations, see the sequel of this article.

Dr. Herschel has also lately observed, that the distance of the two stars forming the double star γ Draconis, Fl. 24 and 25, is $54'' 48'''$, and their position $44^{\circ} 19' N.$ preceding. Whereas, from the right ascension and declination of these stars in Flamsteed's Catalogue, their distance, in his time, appears to have been $1' 11''.418$, and their position $44^{\circ} 23' N.$ preceding. Hence he infers, that as the difference in the distance of these two stars is so considerable, we can hardly account for it, otherwise than by admitting a proper motion in one or the other of the stars, or in our solar system: most probably, he says, neither of the three is at rest. He also suspects a proper motion in one of the double stars in cauda Lyncis media, Fl. 38, and in \circ Ceti, Fl. 68. Phil. Transf. vol. lxxii. part i. p. 117. 143. 150.

It is reasonable to expect, that other instances of the like kind must also occur among the great number of visible stars, because their relative positions may be altered by various

various means. For if our own solar system be conceived to change its place with respect to absolute space, this might, in process of time, occasion an apparent change in the angular distances of the fixed stars; and in such a case, the places of the nearest stars being more affected than of those that are very remote, their relative position might seem to alter, though the stars themselves were really immoveable: and *vice versa*, we may surmise, from the observed motion of the stars, that our sun, with all his planets and comets, may have a motion towards some particular part of the heavens, on account of a greater quantity of matter collected in a number of stars and their surrounding planets there situated, which may perhaps occasion a gravitation of our whole solar system towards it. If this surmise should have any foundation, as Dr. Herschel observes, *ubi supra*, p. 103, it will shew itself in a series of some years; as from that motion will arise another kind of hitherto unknown parallax (suggested by Mr. Michell, *Phil. Transf. vol. lvii. p. 252.*), the investigation of which may account for some part of the motions already observed in some of the principal stars; and for the purpose of determining the direction and quantity of such a motion, accurate observations of the distance of stars that are near enough to be measured with a micrometer, and a very high power of telescopes, may be of considerable use, as they will undoubtedly give us the relative places of those stars to a much greater degree of accuracy than they can be had by transit instruments or sectors, and thereby much sooner enable us to discover any apparent change in their situation, occasioned by this new kind of systematical parallax, if we may so express the change arising from the motion of the whole solar system. For an account of Dr. Herschel's theory of the annual parallax of double stars, with the method of computing from thence what is generally called the parallax of the fixed stars, or of single stars of the first magnitude, such as are nearest to us, see the preceding part of this article, under *Distance of the STARS*.

On the other hand, if our system be at rest, and any of the stars really in motion, this might likewise vary their apparent positions; and the more so, the nearer they are to us, or the swifter their motions are, or the more proper the direction of the motion is to be rendered perceptible by us. Since then the relative places of the stars may be changed from such a variety of causes, considering the amazing distance at which it is certain some of them are placed, it may require the observations of many ages to determine the laws of the apparent changes even of a single star; much more difficult, therefore, must it be to settle the laws relating to all the most remarkable stars.

When the causes which affect the places of all the stars in general are known, such as the precession, aberration, and nutation; it may be of singular use to examine nicely the relative situations of particular stars, and especially of those of the greatest lustre, which, it may be presumed, lie nearest to us, and may therefore be subject to more sensible changes, either from their own motion, or from that of our system. And if at the same time that the brighter stars are compared with each other, we likewise determine the relative positions of some of the smallest that appear near them, whose places can be ascertained with sufficient exactness, we may perhaps be able to judge to what cause the change, if any be observable, is owing. The uncertainty that we are at present under, with respect to the degree of accuracy with which former astronomers could observe, makes us unable to determine several things relating to this subject; but the improvements which have of late years been made in the methods of taking the places of the heavenly bodies are so great, that a few years may hereafter be sufficient to settle

some points, which cannot now be settled, by comparing even the earliest observations with those of the present age.

The first person who pointed out the method of investigating the parallax of the stars, by taking the distances from the zenith of those that pass very near it, was Galileo. The execution of this method was also attempted by Hooke, Flamsteed, Molyneux, and Bradley. See *Distance of the STARS, supra*.

Dr. Hooke communicated several observations on the apparent motions of the fixed stars; and as this was a matter of great importance in astronomy, several of the learned were desirous of verifying and confirming his observations. An instrument was accordingly contrived by Mr. George Graham, and executed with surprising exactness.

With this instrument the star γ , in the constellation Draco, was frequently observed by Messrs. Molyneux, Bradley, and Graham, in the years 1725, 1726; and the observations were afterwards repeated by Dr. Bradley with an instrument contrived by the same ingenious person, Mr. Graham, and so exact, that it might be depended on to half a second. The result of these observations was, that the star did not always appear in the same place, but that its distance from the zenith varied; and that the difference of the apparent places of θ of Themis, the third satellite of Jupiter, amounted to 21 or 22 seconds. Similar observations were made on other stars, and a like apparent motion was found in them, proportional to the latitude of the star. This motion was by no means such as was to have been expected, as the effect of a parallax; and it was some time before any way could be found of accounting for this new phenomenon. At length Dr. Bradley resolved all its variety, in a satisfactory manner, by the motion of light and the motion of the earth compounded together. See LIGHT, and *Phil. Transf. N^o 406. p. 364, or Abr. vol. vi. p. 149, &c.*

Our excellent astronomer, Dr. Bradley, had no sooner discovered the cause, and settled the laws of the aberration of the fixed stars, than his attention was again excited by another new phenomenon, *viz.* an annual change of declination in some of the fixed stars, which appeared to be sensibly greater than a precession of the equinoctial points of 50" in a year, the mean quantity now usually allowed by astronomers, would have occasioned.

This apparent change of declination was observed in the stars near the equinoctial colure, and there appearing at the same time an effect of a quite contrary nature in some stars near the solstitial colure, which seemed to alter their declination less than a precession of 50" required, Dr. Bradley was thereby convinced, that all the phenomena in the different stars could not be accounted for merely by supposing that he had assumed a wrong quantity for the precession of the equinoctial points. He had also, after many trials, sufficient reason to conclude, that these second unexpected deviations of the stars were not owing to any imperfection of his instruments. At length, from repeated observations, he began to guess at the real cause of these phenomena.

It appeared from the doctor's observations, during his residence at Wanstead, from the year 1727 to 1732, that some of the stars near the solstitial colure had changed their declinations 9" or 10" less than a precession of 50" would have produced; and, at the same time, that others near the equinoctial colure had altered theirs about the same quantity more than a like precession would have occasioned; the north pole of the equator seeming to have approached the stars which come to the meridian with the sun about the vernal equinox and the winter solstice; and to have receded from those which come to the meridian with the sun about the autumnal equinox and the summer solstice.

From the consideration of these circumstances, and the

situation of the ascending node of the moon's orbit when he first began to make his observations, he suspected that the moon's action upon the equatorial parts of the earth might produce these effects. For if the precession of the equinox be, according to sir Isaac Newton's principles, caused by the actions of the sun and moon upon those parts; the plane of the moon's orbit being, at one time, above ten degrees more inclined to the plane of the equator than at another, it was reasonable to conclude, that the part of the whole annual precession which arises from her action, would, in different years, be varied in its quantity; whereas the plane of the ecliptic, in which the sun appears, keeping always nearly the same inclination to the equator, that part of the precession which is owing to the sun's action, may be the same every year; and from hence it would follow, that although the mean annual precession, proceeding from the joint actions of the sun and moon, were $50''$; yet the apparent annual precession might sometimes exceed, and sometimes fall short of that mean quantity, according to the various situations of the nodes of the moon's orbit.

In the year 1727, the moon's ascending node was near the beginning of Aries, and consequently her orbit was as much inclined to the equator as it can at any time be; and then the apparent annual precession was found, by the doctor's first year's observations, to be greater than the mean; which proved, that the stars near the equinoctial colure, whose declinations are most of all affected by the precession, had changed theirs above a tenth part more than a precession of $50''$ would have caused. The succeeding year's observations proved the same thing; and in three or four years time the difference became so considerable, as to leave no room to suspect it was owing to any imperfection either of the instrument or observation.

But some of the stars that were near the solstitial colure having appeared to move, during the same time, in a manner contrary to what they ought to have done, by an increase of the precession; and the deviations in them being as remarkable as in the others; it was evident that something more than a mere change in the quantity of the precession would be requisite to solve this part of the phenomenon. Upon comparing the observations of stars near the solstitial colure that were almost opposite to each other in right ascension, they were found to be equally affected by this cause. For whilst γ Draconis appeared to have moved northward, the small star, which is the 35th Camelopardali Hevelii in the British Catalogue, seemed to have gone as much towards the south; which shewed, that this apparent motion in both those stars might proceed from a nutation of the earth's axis; whereas the comparison of the doctor's observations of the same stars, formerly enabled him to draw a different conclusion with respect to the cause of the annual aberrations arising from the motion of light. For the apparent alteration in γ Draconis, from that cause, being as great again as in the other small star, proved that that did not proceed from a nutation of the earth's axis; as, on the contrary, this may. Upon making the like comparison between the observation of other stars that lie nearly opposite in right ascension, whatever their situations were with respect to the cardinal points of the equator, it appeared that their change of declination was nearly equal, but contrary; and such as a nutation or motion of the earth's axis would effect.

The moon's ascending node being got back towards the beginning of Capricorn in the year 1732, the stars near the equinoctial colure appeared about that time to change their declinations no more than a precession of $50''$ required; whilst some of those near the solstitial colure altered theirs above $2''$ in a year less than they ought. Soon after, the an-

nual change of declination of the former was perceived to be diminished, so as to become less than $50''$ of precession would cause; and it continued to diminish till the year 1736, when the moon's ascending node was about the beginning of Libra, and her orbit had the least inclination to the equator. But by this time, some of the stars near the solstitial colure had altered their declinations $18''$ less since the year 1727, than they ought to have done from a precession of $50''$. For γ Draconis, which in those nine years would have gone about $8''$ more southerly, was observed, in 1736, to appear $10''$ more northerly than it did in the year 1727.

As this appearance in γ Draconis indicated a diminution of the inclination of the earth's axis to the plane of the ecliptic, and as several astronomers have supposed that inclination to diminish regularly; if this phenomenon depended upon such a cause, and amounted to $18''$ in nine years, the obliquity of the ecliptic would, at that rate, alter a whole minute in thirty years; which is much faster than any observations before made would allow. The doctor had therefore reason to think, that some part of this motion at least, if not the whole, was owing to the moon's action upon the equatorial parts of the earth, which, he conceived, might cause a libratory motion of the earth's axis. But as he was unable to judge, from only nine years' observations, whether the axis would entirely recover the same position that it had in the year 1727, he found it necessary to continue his observations through a whole period of the moon's nodes; at the end of which he had the satisfaction to see, that the stars returned into the same positions again, as if there had been no alteration at all in the inclination of the earth's axis, which fully convinced him that he had guessed rightly as to the cause of the phenomenon. This circumstance proves likewise, that if there be a gradual diminution of the obliquity of the ecliptic, it does not arise only from an alteration in the position of the earth's axis, but rather from some change in the plane of the ecliptic itself; because the stars, at the end of the period of the moon's nodes, appeared in the same places, with respect to the equator, as they ought to have done if the earth's axis had retained the same inclination to an invariable plane.

The doctor having communicated these observations, and his suspicion of their cause, to the late Mr. Machin, that excellent geometer soon after sent him a table, containing the quantity of the annual precession in the various positions of the moon's nodes, as also the corresponding nutations of the earth's axis; which was computed upon the supposition that the mean annual precession is $50''$, and that the whole is governed by the pole of the moon's orbit only; and, therefore, Mr. Machin imagined, that the numbers in the table would be too large, as, in fact, they were found to be. But it appeared that the changes which Dr. Bradley had observed, both in the annual precession and nutation, kept the same law, as to increasing and decreasing, with the numbers of Mr. Machin's table. Those were calculated upon the supposition, that the pole of the equator, during a period of the moon's nodes, moved round in the periphery of a little circle, whose centre was $23^{\circ} 29'$ distant from the pole of the ecliptic; having itself also an angular motion of $50''$ in a year about the same pole. The north pole of the equator was conceived to be in that part of the small circle which is farthest from the north pole of the ecliptic, at the time when the moon's ascending node is in the beginning of Aries; and in the opposite point of it, when the same node is in Libra.

If the diameter of the little circle, in which the pole of the equator moves, be supposed equal to $18''$, which is the whole quantity of the *nutation*, (which see,) as collected from

Dr. Bradley's observations of the star γ Draconis, then all the phenomena of the several stars which he observed will be very nearly solved by his hypothesis. But for the particulars of his solution, and the application of his theory to the practice of astronomy, we must refer to the excellent author himself, our intention being only to give the history of the invention.

The corrections arising from the aberration of light, and from the nutation of the earth's axis, must not be neglected in astronomical observations; since such neglects might produce errors of near a minute in the polar distances of some stars.

As to the allowance to be made for the aberration of light, Dr. Bradley assures us, that having again examined those of his own observations, which were most proper to determine the transverse axis of the ellipsis which each star seems to describe, he found it to be nearest to $40''$; and this is the number he makes use of in his computations relating to the nutation.

Dr. Bradley says, in general, that experience has taught him, that the observations of such stars as lie nearest the zenith, generally agree best with one another, and are therefore the fittest to prove the truth of any hypothesis. Phil. Trans. No. 485. vol. xlv. p. 1, &c.

Monsieur d'Alembert has published a treatise, entitled "Recherches sur la Precession des Equinoxes et sur la Nutation de la Terre dans le Systeme Newtonien," 4to. Paris, 1749. The calculations of this learned gentleman agree, in general, with Dr. Bradley's observations. But Monsieur d'Alembert finds, that the pole of the equator describes an ellipsis in the heavens, the ratio of whose axes is as 4 to 3; whereas, according to Dr. Bradley, the curve described is either a circle or an ellipsis, the ratio of whose axes is as 18 to 16.

From this digression we shall return to the proper motion of the stars and solar system. This motion was first observed, as we have already suggested, by Dr. Halley, and afterwards by Le Monnier and Cassini. Tobias Mayer had the merit of giving the first explanation of this proper motion; he compared the places of about eighty stars, as determined by Roemer, with his own observations, and he found that the greater number of them had a proper motion. He was apprized that this change of place in the position of the stars might be explained by a progressive motion of the sun towards one quarter of the heavens; but the result of his observations not according with this hypothesis, he concluded, that many centuries might elapse before the true cause of this motion is explained. The possibility of a solar motion was suggested, upon theoretical principles, by the late Dr. Wilson of Glasgow; and M. de la Lande deduced the same opinion from the rotatory motion of the sun; but another kind of argument has completely confirmed these conjectures.

If the sun has a motion in absolute space, directed towards any quarter of the heavens, it is obvious that the stars in that quarter must appear to recede from each other, while those in the opposite region seem gradually approaching. The proper motion of the stars, therefore, in those opposite regions, as ascertained by a comparison of ancient with modern observations, ought to correspond with this hypothesis.

Dr. Herschel has examined this subject with his usual success, and he has certainly discovered the direction in which our system is gradually advancing. He found that the apparent proper motions of about forty-four stars out of fifty-six are very nearly in the direction which should result from a motion of the sun towards the constellation Hercules, or, more accurately, to a point in the heavens, whose right

ascension is $250^{\circ} 52' 30''$, and whose north polar distance is $40^{\circ} 22'$.

Dr. Herschel, in establishing this motion of the starry and solar systems, begins with principles drawn from the theory of attraction, which evidently oppose every idea of absolute rest in any one of the stars, when once it is known that some of them are in motion; for the change that must arise by such motion, in the value of a power which acts inversely as the squares of the distances, must be felt in all the neighbouring stars; and if these be influenced by the motion of the former, they will again affect those that are next to them, and so on till all are in motion. Now as we know that several stars, in divers parts of the heavens, do actually change their place, it will follow, that the motion of our solar system is not a mere hypothesis; and this consideration will be confirmed by the reasons that induce us to suppose, that most of those very stars which have been observed to move, to be such as are nearest to us; and, therefore, their influence on our situation would of itself be a powerful argument in favour of the proper motion of the sun, if it had been originally at rest. Moreover, it seems very natural, that the changes which are observed to take place among the stars; such as the increase of magnitude in many, and the gradual disappearance of others; the periods of some not before observed, and the distances of many that are actually changing, while many more are suspected to have a considerable motion; afford a strong suspicion that most probably every star in the heavens is more or less in motion. Allowing the proper motion of the stars, it must follow, that our system, with all its planets and comets, that is, the solar system, is not less liable to such a general agitation as is found to obtain among all the other celestial bodies. Astronomers have already observed what they call a proper motion in several of the fixed stars, and the same may be supposed of them all. We ought, therefore, to resolve that which is common to all the stars, which are found to have what has been called a proper motion, into a single real motion of the solar system, as far as that will answer the known facts, and only to attribute to the proper motion of each particular star the deviations from the general law the stars seem to follow in those movements.

By Dr. Maskelyne's account of the proper motion of some principal stars, we find that Sirius, Castor, Procyon, Pollux, Regulus, Arcturus, and α Aquilæ, appear to have respectively the following proper motions in right ascension; $-0''.63$; $-0''.28$; $-0''.80$; $-0''.93$; $-0''.41$; $-1''.40$; and $+0''.57$; and two of them, Sirius and Arcturus, in declination, *viz.* $1''.20$ and $2''.01$, both southward.

Since the apparent motions of these seven stars may be accounted for, either by supposing them to move just as they appear to do, or else by supposing the sun alone to have a motion in a direction such as Dr. Herschel assigns to it, we are no more authorised to suppose the sun at rest than we should be to deny the diurnal motion of the earth, except in this respect, that the proofs of the latter are very numerous, whereas the former rests only on a few though capital testimonies. Our author finds from other considerations, founded on a table by M. de la Lande of the proper motion of twelve stars, both in right ascension and declination, for fifty years, (Phil. Trans. vol. lxxiii. p. 270, &c.), that this motion of the sun, or solar system, is directed towards the star λ Herculis; and he mentions some very striking circumstances in the quantities of the real proper motions of the stars that deserve notice. First, Arcturus and Sirius being the largest of the stars, and therefore probably the nearest, ought to have the most apparent motion, both in right ascension and declination, which is agreeable to observation. Next, in regard to the right

ascension only, Arcturus being better situated to shew its motion, ought to have it much larger, which we find it has. Aldebaran, both badly situated and considerably smaller than the two former, ought to shew but little motion. Procyon, better situated than Sirius, though not quite so large, should have almost as much motion; for, on supposing it farther off because it appears smaller, the effect of the sun's motion will be lessened upon it; whereas, on the other hand, its better situation will partly compensate for its greater distance. ϵ Cygni, very favourably situated, though but a small star, should shew it considerably as well as α Aquilæ; whereas β Cygni should have but little motion; and γ Piscium, best situated of all, should have a great increase of right ascension.

In the last place, a very striking agreement with the hypothesis is displayed in Castor and Pollux. They are both pretty well situated; and we accordingly find that Pollux, for the size of the star, shews as much motion in right ascension as we could expect: but it is remarkable, and seemingly contrary to our hypothesis, that Castor, equally well placed, shews no more than one half of the motion of Pollux. Now, if we recollect that the former is a double star, consisting of two stars not much different in size, we can allow but about half the light to each of them, which affords a strong presumption of their being at a greater distance, and therefore their partial systematical parallax ought to be so much less than that of Pollux, which agrees wonderfully with observation. Not to mention the great difficulty in which we should be involved, were we to suppose the motion of Castor to be really in the star; for how extraordinary must appear the concurrence, that two stars, namely, those that make up this apparently single star, should both have a proper motion so exactly alike, that in all our observations hitherto they have not been found to disagree a single second, either in right ascension or declination, for fifty years together! Does not this seem strongly to point out the common cause, the motion of the solar system?

As to the quantity of the solar motion, Dr. Herschel suggests the following hints. From the annual parallax of the fixed stars, which, from observations, he finds much less than it has hitherto been proved to be, we may certainly admit, that the diameter of the earth's orbit, at the distance of Sirius or Arcturus, would not nearly subtend an angle of one second; but the apparent motion of Arcturus, if owing to a translation of the solar system, amounts to no less than $2''.7$ a-year, as will appear if we compound the two motions of $1' 11''$ in right ascension, and $1' 55''$ in declination, into one single motion, and reduce it to an annual quantity. Hence we may, in a general way, estimate, that the solar motion can certainly not be less than that which the earth has in her annual orbit.

By considering the motion of the satellites round their primary planets, and of the primary planets round the sun, Dr. Herschel is led to suppose that the proper motion of the sun is not rectilinear, but that it is performed round some distant and unknown centre. Although we may not acquiesce in the hypothesis, that there is any immense central body of sufficient magnitude to carry round it all the systems with which astronomers have filled the regions of space, yet we may suppose, with M. de la Lande, that there is a kind of equilibrium among all the systems of the world, and that they have all a periodical circulation round their common centre of gravity. See Phil. Transf. vol. xcvi. p. 233—256. Lalande's Astron. tom. iii.

The following table contains the proper motion of 36 of the principal fixed stars in right ascension and declination, according to the accurate observations of Dr. Maskelyne.

TABLE of the Annual Proper Motion of 36 Stars in Right Ascension and Declination.

Names of the Stars.	Magnitude.	Annual proper Motion in Right Ascension.	Annual proper Motion in Declination.
		Seconds.	Seconds.
γ Pegasi - -	2	- 0.09	- 0.15 N.
α Arietis - -	2.3	+ 0.10	+ 0.07 S.
α Ceti - - -	2	- 0.12	- 0.08 N.
Aldebaran - -	1	+ 0.03	+ 0.12 S.
Capella - - -	1	+ 0.21	+ 0.44 S.
Rigel - - -	1	- 0.03	- 0.16 N.
β Tauri - - -	2	+ 0.01	+ 0.10 S.
α Orion - - -	1	+ 0.01	- 0.13 N.
Sirius - - -	1	- 0.42	+ 1.04 S.
Castor - - -	2	- 0.15	+ 0.44 S.
Procyon - - -	1.2	- 0.80	+ 0.95 S.
Pollux - - -	2	- 0.74	0.00
α Hydræ - - -	2	- 0.09	- 0.14 N.
Regulus - - -	1	- 0.22	- 0.08 N.
β Leonis - - -	1.2	- 0.57	+ 0.07 S.
β Virginis - -	3	+ 0.74	+ 0.24 S.
Spica Virginis -	1	- 0.02	- 0.19 N.
Arcturus - - -	1	- 1.26	+ 1.72 S.
1 } α Libræ - - -	6	- 0.11	- 0.18 N.
2 } - - - - -		2	- 0.11	- 0.15 N.
α Cor. Bor. - -	2.3	+ 0.26	+ 0.03 S.
α Serpentis - -	2	+ 0.11	- 0.19 N.
Antares - - -	1	0.00	- 0.26 N.
α Herculis - -	2	0.00	- 0.23 N.
α Ophiuchi - -	2	+ 0.06	+ 0.05 S.
α Lyræ - - -	1	+ 0.23	- 0.27 N.
γ } Aquilæ - - -	3	- 0.11	- 0.16 N.
β } - - - - -		1.2	+ 0.48	- 0.54 N.
1 } α Capricorni -	3	- 0.03	+ 0.35 S.
2 } - - - - -		3	0.00	- 0.28 N.
α Cygni - - -	3	+ 0.05	- 0.26 N.
α Aquarii - - -	1.2	- 0.08	- 0.03 N.
α Aquarii - - -	3	- 0.08	- 0.19 N.
Fomalhaut - -	1.2	+ 0.35	- 0.06 N.
α Pegasi - - -	2	- 0.06	- 0.18 N.
α Andromedæ -	2	+ 0.08	+ 0.06 S.

In the following table we have given the proper motion of nine principal fixed stars in longitude and latitude, according to the most recent observations of Dr. Maskelyne, including the precession, &c.

Names of the Stars.	Annual Increase of Longitude.	Annual Variation of Latitude.
α Arietis - -	" 50.271	+ " 0.180
Aldebaran - -	50.204	- 0.317
Pollux - - -	49.470	+ 0.280
Regulus - - -	50.004	+ 0.200
Spica Virginis -	50.059	+ 0.080
Antares - - -	50.141	+ 0.167
α Aquilæ - - -	50.870	+ 0.372
Fomalhaut - -	50.717	+ 0.013
α Pegasi - - -	50.133	+ 0.163

STARS.

Catalogue of 600 principal Stars, visible at Paris, for the Beginning of 1810, after the latest Observations, by
Michael Lalande, Nephew.

Names and Magnitudes of the Stars.	Mean Right Ascension, Jan. 1, 1810.			Annual Variation.	Mean Declination, Jan. 1, 1810.			Annual Variation.
	H. M.	D. M. S.	D. M. S.					
88 γ Pegafus - 2	0 3	0 51 55	46.0	14 7 38 N.	+ 20.0			
8 δ Cetus - 3	0 9	2 26 10	45.9	9 52 38 S.	- 20.1			
15 \times Calliopeia - 4	0 22	5 34 22	49.6	61 52 52 N.	+ 20.0			
17 ζ Calliopeia - 4	0 26	6 36 41	49.0	52 50 59 N.	+ 19.9			
30 ϵ Andromeda 4	0 28	7 8 10	47.2	28 16 51 N.	+ 19.9			
31 δ Andromeda 3	0 29	7 17 57	47.8	29 49 13 N.	+ 19.8			
18 α Calliopeia - 3	0 30	7 26 54	49.8	55 29 36 N.	+ 19.8			
16 β Cetus - 2	0 34	8 30 43	45.2	19 1 52 S.	- 19.9			
34 ζ Andromeda 4	0 37	9 19 21	47.3	23 13 55 N.	+ 19.8			
24 η Calliopeia - 4	0 38	9 25 9	52.8	56 48 23 N.	+ 19.9			
63 δ Pifces - 4	0 39	9 42 27	46.3	6 33 3 N.	+ 19.7			
35 ν Andromeda 4	0 39	9 50 38	48.8	40 2 31 N.	+ 19.7			
27 γ Calliopeia - 3	0 45	11 19 55	52.7	59 41 9 N.	+ 19.6			
37 μ Andromeda 4.3	0 46	11 33 38	49.0	37 27 38 N.	+ 19.6			
71 ϵ Pifces - 4	0 53	13 16 25	46.6	6 51 55 N.	+ 19.5			
α Polaris - 2.3	0 54	13 38 17	204.4	88 17 40 N.	+ 19.5			
31 η Cetus - 3.4	0 59	14 45 28	44.9	11 11 24 S.	- 19.4			
43 β Andromeda 2	0 59	14 46 52	49.9	34 36 38 N.	+ 19.3			
33 θ Calliopeia - 4	1 0	14 54 7	53.0	54 8 7 N.	+ 19.4			
86 ζ Pifces - 4	1 4	15 57 4	46.6	6 34 7 N.	+ 19.3			
46 Andromeda 4.5	1 11	17 48 6	51.9	44 31 48 N.	+ 19.1			
37 δ Calliopeia - 3	1 13	18 22 12	56.4	59 14 39 N.	+ 19.0			
45 θ Cetus - 3	1 15	18 37 53	44.9	9 9 56 S.	- 19.0			
48 Andromeda 5	1 16	19 5 1	52.3	44 25 19 N.	+ 18.9			
49 ξ Andromeda 5	1 19	19 41 24	52.9	46 1 23 N.	+ 18.9			
99 η Pifces - 4	1 21	20 20 0	47.8	14 21 46 N.	+ 18.8			
102 π Pifces - 4.5	1 27	21 45 36	47.5	11 9 58 N.	+ 18.6			
106 ν Pifces - 4.5	1 32	22 53 18	46.5	4 31 21 N.	+ 18.5			
54 ϕ Andromeda 4	1 32	22 57 18	55.1	49 43 37 N.	+ 18.5			
52 τ Cetus - 3.4	1 35	23 48 55	43.5	16 56 38 S.	- 18.3			
110 \circ Pifces - 4.5	1 35	23 50 34	47.2	8 11 51 N.	+ 18.4			
45 ϵ Calliopeia - 3	1 41	25 12 55	62.3	62 43 40 N.	+ 18.1			
55 ζ Cetus - 3	1 42	25 31 12	44.2	11 16 37 S.	- 18.1			
2 α Triangularis B 3.4	1 42	25 34 7	50.6	28 38 54 N.	+ 18.1			
5 γ Aries <i>middle</i> 4	1 43	25 46 53	48.8	18 21 34 N.	+ 18.1			
6 β Aries - 3	1 44	26 2 28	49.4	19 52 28 N.	+ 18.0			
50 f Calliopeia 4.5	1 47	26 51 57	72.7	71 29 34 N.	+ 17.9			
113 α Pifces - 3	1 52	28 3 22	46.3	1 50 30 N.	+ 17.6			
57 γ Andromeda 2	1 52	28 4 18	54.6	41 24 42 N.	+ 17.6			
213 α Aries - 3	1 56	29 7 16	50.2	22 33 31 N.	+ 17.5			
4 β Triangularis B 4	1 58	29 34 9	52.6	34 5 0 N.	+ 17.4			
9 γ Triangularis B 4	2 6	31 30 46	52.6	32 57 40 N.	+ 17.1			
68 \circ Cetus 2 - 10	2 10	32 26 19	45.2	3 50 40 S.	- 16.9			
35 Calliopeia, Hev. 4	2 13	33 23 51	71.1	66 32 19 N.	+ 16.8			
72 ρ Cetus - 4	2 17	33 56 30	43.3	13 9 6 S.	- 16.6			
73 ξ Cetus - 4	2 18	34 31 4	47.4	7 36 12 N.	+ 16.7			
76 σ Cetus - 4	2 23	35 46 15	42.5	16 4 57 S.	- 16.3			
82 δ Cetus - 3	2 30	37 26 16	45.8	0 29 48 S.	- 15.9			
83 ϵ Cetus - 3	2 30	37 35 37	43.2	12 40 57 S.	- 15.9			
13 θ Perfeus - 4	2 31	37 49 10	59.7	48 25 0 N.	+ 15.9			
35 Mouv. Lyf. - 4	2 32	38 5 2	52.2	26 53 33 N.	+ 15.8			

STARS.

Names and Magnitudes of the Stars.	Mean Right Ascension, Jan. 1, 1810.			Annual Variation.	Mean Declination, Jan. 1, 1810.			Annual Variation.
	H.	M.	D. M. S.		D.	M.	S.	
86 γ Cetus - 3	2	33	38 22 5	46.4	2	25	50 N.	+ 15.7
87 μ Cetus - 4	2	35	38 40 11	48.0	9	18	22 N.	+ 15.7
89 π Cetus - 3	2	35	38 46 14	42.6	14	40	2 S.	- 15.6
1 τ^1 Eridanus - 4	2	36	39 3 28	41.5	19	22	57 S.	- 15.6
39 γ B. Lys - 4	2	37	39 9 24	52.7	28	27	5 N.	+ 15.6
η Perfeus, 9 Hev. - 4	2	37	39 13 51	64.0	55	5	50 N.	+ 15.6
16 ρ^1 Perfeus - 4	2	39	39 39 26	55.7	37	31	44 N.	+ 15.5
41 γ A. Lys - 4	2	39	39 42 26	52.3	26	28	15 N.	+ 15.4
18 τ Perfeus - 5	2	41	40 12 57	62.4	51	58	39 N.	+ 15.3
2 τ^2 Eridanus - 4	2	42	40 36 17	40.7	21	47	31 S.	- 15.2
21 Perfeus - 4.5	2	46	41 26 48	53.9	31	9	41 N.	+ 15.0
22 π of Perfeus - 4	2	47	41 39 50	56.6	38	53	36 N.	+ 15.0
3 η Eridanus - 3	2	47	41 47 17	43.8	9	39	32 S.	- 15.0
91 λ Cetus - 4	2	50	42 23 8	47.8	8	8	36 N.	+ 14.8
23 γ Perfeus - 3	2	51	42 46 44	63.7	52	45	13 N.	+ 14.7
92 α Cetus - 2	2	52	43 5 20	46.7	3	20	15 N.	+ 14.7
25 ρ Perfeus - 4	2	53	43 15 37	56.6	38	5	44 N.	+ 14.6
11 Eridanus - 4	2	54	43 30 15	39.7	24	22	28 S.	- 14.6
10 ρ^3 Eridanus - 4	2	55	43 47 13	43.9	8	20	59 S.	- 14.5
26 β Perfeus, var. 2.5	2	56	43 57 48	57.8	40	12	54 N.	+ 14.5
27 κ Perfeus - 4.5	2	57	44 10 54	59.4	44	7	43 N.	+ 14.4
57 δ Aries - 4	3	1	45 11 41	50.8	19	0	2 N.	+ 14.2
12 Eridanus - 3.4	3	4	45 59 53	37.7	29	44	38 S.	- 13.9
13 ζ Eridanus - 3	3	7	46 39 8	43.5	9	31	56 S.	- 13.8
33 α Perfeus - 2	3	11	47 42 12	63.0	49	10	30 N.	+ 13.5
16 Eridanus - 3.4	3	11	47 45 57	39.8	22	27	19 S.	- 13.5
97 κ^2 Libra - 4	3	11	47 47 50	46.7	2	59	4 N.	+ 13.5
2 Gira. Hev. - 4	3	14	48 26 44	71.0	59	15	54 N.	+ 13.3
1 \circ Taurus - 4	3	15	48 39 3	48.1	8	21	11 N.	+ 13.3
4 Gira. Hev. - 4.5	3	16	48 53 56	67.2	54	46	59 N.	+ 13.2
2 ξ Taurus - 4	3	17	49 13 14	48.3	9	3	49 N.	+ 13.1
35 σ Perfeus - 5	3	17	49 18 37	62.3	47	19	41 N.	+ 13.1
5 f Taurus - 5	3	20	50 5 56	49.2	12	16	38 N.	+ 12.9
17 Eridanus - 4.5	3	21	50 17 54	44.4	5	44	1 S.	- 12.8
37 \downarrow Perfeus - 5	3	23	50 45 38	62.8	47	32	57 N.	+ 12.7
18 ϵ Eridanus - 3	3	24	50 59 47	42.3	10	6	29 S.	- 12.6
19 Eridanus - 4	3	25	51 20 59	39.5	22	16	35 S.	- 12.5
10 Taurus - 4.5	3	27	51 47 48	45.9	0	12	23 S.	- 12.4
39 δ Perfeus - 3	3	29	52 21 45	63.0	47	10	8 N.	+ 12.3
41 ν Perfeus - 4	3	32	53 4 56	60.3	41	58	1 N.	+ 12.1
23 δ Eridanus - 3	3	34	53 32 18	42.9	10	24	50 S.	- 12.5
25 η Pleiades - 3	3	36	54 3 7	53.1	23	30	29 N.	+ 11.8
26 π Eridanus - 4	3	37	54 17 27	42.3	12	42	17 S.	- 11.7
27 Eridanus - 4	3	39	54 40 10	38.7	23	48	59 S.	- 11.6
44 ζ Perfeus - 3	3	42	55 33 12	55.9	31	18	32 N.	+ 11.4
46 P. Cat. 1712 - 5	3	42	55 35 0	63.8	47	18	6 N.	+ 11.4
g Eridanus - 4	3	42	55 35 18	33.6	36	46	51 S.	- 11.3
45 ϵ Perfeus - 3	3	45	56 17 7	59.6	39	26	59 N.	+ 11.2
33 Eridanus - 4.5	3	46	56 24 23	38.1	25	10	48 S.	- 11.1
34 γ Eridanus - 3	3	49	57 17 32	41.8	14	3	21 S.	- 10.9
35 λ Taurus - 4	3	50	57 32 27	49.5	11	56	42 N.	+ 10.8
36 k Eridanus - 4	3	52	57 57 24	38.2	24	33	39 S.	- 10.7
47 λ Perfeus - 4	3	52	58 7 13	66.0	49	49	22 N.	+ 10.6
38 ν Taurus - 4	3	53	58 15 52	47.5	5	27	15 N.	+ 10.6
37 A ¹ Taurus - 4.5	3	53	58 22 10	52.8	21	33	10 N.	+ 10.5

STARS.

Names and Magnitudes of the Stars.	Mean Right Ascension, Jan. 1, 1810.			Annual Variatinn.	Mean Declination, Jan. 1, 1810.			Annual Variation.
	H. M.	D. M. S.	D. M. S.					
51 μ Perfeus - 4	4 1	60 14 54	65.1	47 54 50 N.	+ 10.0			
38 \circ Eridanus - 4	4 3	60 38 55	43.7	7 20 26 S.	- 9.9			
49 μ Taurus - 4	4 5	61 18 24	48.5	8 24 28 N.	+ 9.7			
54 γ Taurus - 3	4 9	62 14 52	51.0	15 9 31 N.	+ 9.4			
41 Eridanus - 3.4	4 11	62 40 35	33.8	34 16 5 S.	- 9.2			
61 δ^1 Taurus - 3.4	4 12	62 59 49	51.5	17 5 16 N.	+ 9.1			
64 δ^2 Taurus - 4.6	4 13	63 17 17	51.4	16 59 42 N.	+ 9.1			
42 ξ Eridanus - 3.4	4 14	63 33 20	44.6	4 11 34 S.	- 9.0			
43 d Eridanus - 4	4 17	64 13 31	33.6	34 28 3 S.	- 8.7			
74 ϵ Taurus - 3.4	4 18	64 23 0	52.3	18 44 52 N.	+ 8.6			
87 Aldebaran - 1	4 25	66 15 25	51.4	16 7 1 N.	+ 8.0			
47 Eridanus - -	4 25	66 15 45	43.1	8 38 14 S.	- 8.1			
50 v^1 Eridanus - 4	4 26	66 30 53	35.3	30 9 18 S.	- 8.0			
48 v Eridanus - 4	4 27	66 42 26	44.7	3 44 57 S.	- 8.0			
51 C. Eridanus - 4	4 28	67 0 42	45.0	2 51 42 S.	- 7.9			
52 v^2 Eridanus - 4	4 28	67 2 32	34.9	30 57 29 S.	- 7.8			
53 Eridanus - 3.4	4 29	67 22 11	40.9	14 40 59 S.	- 7.6			
54 Eridanus - 3	4 32	68 2 0	39.1	20 2 35 S.	- 7.5			
9 Camelopardalis 4	4 35	68 48 53	87.8	66 0 5 N.	+ 7.3			
57 μ Eridanus - 4	4 36	69 0 4	44.7	3 36 41 S.	- 7.2			
1 Orion - 4	4 40	69 52 57	48.2	6 37 10 N.	+ 7.0			
2 π^1 Orion - 4	4 40	70 3 55	48.8	8 33 52 N.	+ 6.9			
3 Orion - 4	4 41	70 16 26	47.7	5 16 17 N.	+ 6.8			
4 \circ^1 Orion - 4.5	4 42	70 26 53	50.6	13 55 28 N.	+ 6.8			
8 z Orion - 4	4 44	71 5 22	46.6	2 7 15 N.	+ 6.5			
3 ι Auriga - 4	4 45	71 9 29	58.1	32 51 13 N.	+ 6.5			
9 \circ^2 Orion - 4.5	4 46	71 25 27	50.4	13 12 20 N.	+ 6.4			
10 Camelopardalis 4.5	4 47	71 38 42	79.1	60 8 51 N.	+ 6.4			
7 ϵ Auriga - 4	4 48	72 5 18	64.2	43 31 42 N.	+ 6.2			
10 Orion - 4.5	4 49	72 10 36	46.4	1 24 47 N.	+ 6.2			
8 ζ Auriga - 4	4 49	72 18 21	62.4	40 47 5 N.	+ 6.1			
102 ι Taurus - 4	4 52	72 56 11	53.5	21 18 21 N.	+ 5.9			
10 n Auriga - 4	4 53	73 18 10	62.6	40 57 48 N.	+ 5.8			
2 ϵ Lepus - 4	4 57	74 21 13	37.9	22 38 0 S.	- 5.4			
67 β Eridanus - 3	4 59	74 37 40	43.9	5 20 29 S.	- 5.4			
69 λ Eridanus - 4	5 0	75 0 41	42.8	9 0 21 S.	- 5.2			
Capricornus - 1	5 3	75 40 4	66.2	45 47 24 N.	+ 4.6			
5 μ Lepus - 4	5 4	76 5 57	40.2	16 26 18 S.	- 4.9			
19 Rigel - 1	5 5	76 21 7	43.1	8 25 49 S.	- 4.7			
20 τ Orion - 4	5 8	77 5 49	43.5	7 3 33 S.	- 4.5			
112 β Taurus - 2	5 14	78 34 20	56.7	28 26 3 N.	+ 3.9			
28 n Orion - 3	5 15	78 43 55	45.0	2 34 53 S.	- 4.0			
24 γ Orion - 2	5 15	78 44 8	48.1	6 10 1 N.	+ 3.9			
9 β Lepus - 3.4	5 20	80 1 37	38.5	20 55 9 S.	- 3.5			
34 δ Orion - 2	5 22	80 34 30	45.7	0 27 0 S.	- 3.3			
36 v Orion - 4	5 23	80 41 10	43.4	7 26 59 S.	- 3.3			
11 α Lepus - 3	5 24	81 5 14	39.5	17 58 1 S.	- 3.1			
ϵ Columba - 4	5 24	81 7 0	31.8	35 36 56 S.	- 3.1			
39 λ Orion - 4	5 25	81 10 8	49.3	9 47 50 N.	+ 3.1			
44 ι Orion - 3.4	5 26	81 32 9	43.8	6 2 34 S.	- 3.0			
123 ζ Taurus - 3	5 26	81 34 24	53.5	21 0 57 N.	+ 3.0			
46 ϵ Orion - 2	5 27	81 38 36	45.4	1 20 1 S.	- 2.9			
125 Taurus - 5	5 28	81 59 28	55.5	25 46 45 N.	+ 2.8			
48 σ Orion - 4	5 29	82 18 7	45.0	2 43 7 S.	- 2.5			
50 ζ Orion - 2	5 31	82 47 36	45.2	2 3 12 S.	- 2.6			

STARS.

Names and Magnitudes of the Stars.	Mean Right Ascension, Jan. 1, 1810.			Annual Variation.	Mean Declination, Jan. 1, 1810.			Annual Variation.
	H. M.	D. M. S.	D. M. S.					
α Columba - 2	5 33	83 11 33	32.5	34 10 57 S.	- 2.4			
13 γ Lepus - 3.4	5 37	84 8 6	37.4	23 31 7 S.	- 2.1			
132 Taurus - 4	5 37	84 20 22	55.0	24 29 33 N.	+ 2.0			
14 ζ Lepus - 4	5 38	84 35 7	40.6	14 54 5 S.	- 1.9			
53 \times Orion - 2.3	5 39	84 41 11	42.6	9 44 45 S.	- 1.9			
15 δ Lepus - 3.4	5 43	85 47 11	38.3	20 54 5 S.	- 1.5			
33 δ Auriga - 4	5 44	85 58 14	73.7	54 15 14 N.	+ 1.5			
β Columba - 3	5 44	86 4 0	31.5	35 50 50 S.	- 1.4			
58 α Orion - 1	5 45	86 13 18	48.6	7 21 39 N.	+ 1.4			
34 β Auriga - 2.3	5 46	86 23 53	66.0	44 54 48 N.	+ 1.3			
37 θ Auriga - 3.4	5 47	86 41 32	61.1	37 11 12 N.	+ 1.2			
16 η Lepus - 4	5 48	86 56 18	40.9	14 12 37 S.	- 1.1			
γ Columba - 4	5 51	87 42 3	31.8	35 18 59 S.	- 0.8			
61 μ Orion - 4	5 52	87 58 56	49.3	9 38 14 N.	+ 0.8			
1 H. of G. Prop. 5	5 53	88 8 32	54.6	23 15 45 N.	+ 0.7			
67 ν Orion - 4.5	5 57	89 10 48	51.3	14 46 50 N.	+ 0.3			
18 θ Lepus - 4	5 58	89 23 21	40.6	14 55 42 S.	- 0.3			
2 Lynx - 4	6 3	90 42 42	79.3	59 3 41 N.	- 0.2			
7 η Gemini - 2.3	6 3	90 51 5	54.4	22 32 58 N.	- 0.2			
13 μ Gemini - 3	6 11	92 51 55	54.5	22 35 57 N.	- 1.2			
1 ζ Canis Major 2.3	6 13	93 15 15	34.4	29 59 7 S.	+ 1.1			
8 Monoceros - 4	6 14	93 25 28	47.6	4 40 49 N.	- 1.2			
2 β Canis Major 2.3	6 14	93 34 59	39.6	17 52 18 S.	+ 1.2			
3 λ Canis Major 4	6 15	93 47 32	32.8	33 20 48 S.	+ 1.3			
18 ν Gemini - 4	6 18	94 25 12	53.3	20 19 18 N.	- 1.5			
13 Monoceros - 4	6 23	95 39 22	48.5	7 27 42 N.	- 1.9			
24 γ Gemini - 2.3	6 27	96 40 57	51.9	16 33 0 N.	- 2.4			
15 Monoceros - 4	6 31	97 37 40	49.5	10 3 45 N.	- 2.6			
42 Camelopardalis 4.5	6 31	97 46 8	94.5	67 45 41 N.	- 2.6			
27 ϵ Gemini - 4	6 32	98 3 29	55.3	25 18 27 N.	- 2.8			
43 Camelopardalis 4.5	6 33	98 17 21	97.8	69 5 14 N.	- 2.8			
31 ξ Gemini - 4	6 35	98 39 21	50.5	13 5 30 N.	- 3.0			
9 Sirius - 1	6 37	99 11 34	39.8	16 27 49 S.	+ 4.2			
18 Monoceros - 4	6 38	99 29 14	46.8	2 36 44 N.	- 3.3			
34 θ Gemini - 4	6 40	100 3 47	59.5	34 10 37 N.	- 3.5			
13 κ Canis Major 4	6 43	100 41 12	33.5	32 17 43 S.	+ 3.7			
18 μ Canis Major 4	6 47	101 51 8	41.1	13 48 22 S.	+ 4.1			
20 ι Canis Major 4	6 48	101 54 59	40.0	16 48 54 S.	+ 4.1			
21 ϵ Canis Major 3	6 51	102 47 22	35.3	28 43 15 S.	+ 4.4			
43 ζ Gemini - 3	6 53	103 12 29	53.4	20 50 21 N.	- 4.5			
22 Canis Major - 4	6 54	103 32 16	35.7	27 40 11 S.	+ 4.7			
24 \omicron Canis Major 4	6 55	103 46 20	37.4	23 33 47 S.	+ 4.7			
23 γ Canis Major 2	6 55	103 47 23	40.7	15 21 39 S.	+ 4.8			
25 δ Canis Major 2	7 1	105 9 59	36.5	26 5 55 S.	+ 5.2			
55 δ Gemini - 3	7 9	107 11 27	53.9	22 19 15 N.	+ 5.9			
π Argo Navis 3	7 10	107 36 31	31.7	36 45 45 S.	+ 6.0			
60 ι Gemini - 4	7 14	108 28 43	56.1	28 9 56 N.	- 6.3			
31 η Canis Major 2	7 17	109 8 38	35.6	28 56 25 S.	+ 6.6			
3 β Canis Minor 3	7 17	109 12 34	40.9	8 39 45 N.	- 6.7			
66 α Castor - 1.2	7 22	110 36 48	57.8	32 17 35 N.	- 7.0			
69 ν Gemini - 4.5	7 24	111 2 59	55.6	27 18 30 N.	- 7.1			
Procyon - 1.2	7 29	112 20 13	47.1	5 42 13 N.	- 8.5			
26 Monoceros - 4	7 32	113 2 32	43.0	9 6 56 S.	+ 7.8			
77 \times Gemini - 4	7 33	113 14 26	54.5	24 50 37 N.	- 7.9			
78 β Pollux - 2.3	7 34	113 25 3	55.3	28 28 27 N.	- 7.9			

STARS.

Names and Magnitudes of the Stars.	Mean Right Ascension, Jan. 1, 1810.					Annual Variation.	Mean Declination, Jan. 1, 1810.			Annual Variation.
	H.	M.	D.	M.	S.		D.	M.	S.	
7 ξ Argo Navis 3.4	7	41	115	19	33	37.8	24	23	26 S.	+ 8.6
9 Argo Navis - 4	7	43	115	44	33	41.7	13	23	57 S.	+ 8.7
11 ϵ Argo Navis 4	7	49	117	10	22	38.6	22	22	48 S.	+ 9.1
13 Argo Navis - 4	7	52	118	5	35	46.8	2	50	55 N.	- 9.4
ζ Argo Navis - 2	7	57	119	13	36	31.5	39	28	22 S.	+ 9.8
14 \downarrow^2 Cancer - 4	7	59	119	44	53	54.5	26	4	31 N.	- 9.9
15 ι Argo Navis 3.4	7	59	119	51	55	38.4	23	45	49 S.	+ 10.0
57 Camelopardalis 5	8	3	120	39	44	80.0	63	4	46 N.	- 10.1
17 β Cancer - 3.4	8	6	121	32	59	48.9	9	45	45 N.	- 10.5
1 \circ Urfa Major 4.5	8	14	123	35	46	76.6	61	20	24 N.	- 10.9
30 Monoceros - 4	8	16	124	2	25	45.0	3	17	36 S.	+ 11.2
4 δ Hydra - 4	8	28	126	53	48	47.8	6	21	33 N.	- 12.0
43 γ Cancer - 4	8	32	128	4	4	52.4	22	8	36 N.	- 12.4
7 η Hydra - 4	8	33	128	19	15	47.1	4	4	25 N.	- 12.4
47 δ Cancer - 4	8	34	128	28	0	51.4	18	50	41 N.	- 12.7
31 Monoceros - 4	8	34	128	35	3	44.1	6	33	21 S.	+ 12.5
11 ϵ Hydra - 4	8	37	129	10	37	47.9	7	6	30 N.	- 12.6
16 ζ Hydra - 4.5	8	45	131	20	9	47.7	6	39	43 N.	- 13.2
60 α^1 Cancer - 4	8	46	131	23	9	49.3	12	20	39 N.	- 13.2
9 ι Urfa Major 3	8	46	131	32	11	63.2	48	46	45 N.	- 13.3
65 α^2 Cancer - 4	8	48	132	1	13	49.4	12	35	6 N.	- 13.5
10 η Urfa Major 4	8	48	132	4	0	59.6	42	31	39 N.	- 13.4
12 κ Urfa Major 3.4	8	51	132	39	0	62.3	47	53	57 N.	- 13.5
17 Urfa Major. Hev. 4	8	54	133	36	4	57.8	39	12	14 N.	- 13.8
76 κ Cancer - 4	8	57	134	21	44	48.8	11	25	34 N.	- 14.0
22 θ Hydra - 4	9	4	136	6	57	46.7	3	6	42 N.	- 14.4
38 Lynx - 4	9	7	136	44	41	56.5	37	35	59 N.	- 14.5
40 Lynx - 4	9	9	137	21	44	55.5	35	11	20 N.	- 14.7
1 κ Leo - 4	9	14	138	23	27	52.7	26	59	42 N.	- 14.9
24 d Urfa Major 4.5	9	17	139	21	54	83.3	70	39	18 N.	- 15.1
30 α Hydra - 2	9	18	139	33	43	44.2	7	50	26 S.	+ 15.1
25 θ Urfa Major 3.4	9	20	140	1	4	61.1	52	32	6 N.	- 15.9
4 λ Leo - 4	9	21	140	12	49	51.6	23	48	3 N.	- 15.4
5 ξ Leo - 4	9	22	140	25	25	48.7	12	8	12 N.	- 15.4
\downarrow Argo Navis 4	9	23	140	48	0	35.4	39	38	21 S.	+ 15.5
35 ι Hydra - 4	9	30	142	32	6	45.9	0	17	6 S.	+ 15.9
14 \circ Leo - 4	9	31	142	44	59	48.2	10	45	5 N.	- 15.9
17 ϵ Leo - 4	9	35	143	45	37	51.5	24	38	38 N.	- 16.1
29 ν Urfa Major 4	9	37	144	20	46	66.2	59	55	30 N.	- 16.2
24 μ Leo - 3	9	42	145	28	59	51.8	26	53	46 N.	- 16.5
27 ν Leo - 4.5	9	48	146	59	47	48.5	13	20	49 N.	- 16.8
29 π Leo - 4	9	50	147	32	21	47.7	8	57	4 N.	- 16.9
30 η Leo - 3	9	57	149	14	24	49.2	17	41	7 N.	- 17.2
15 Sextans - 4	9	58	149	33	5	46.0	0	33	11 N.	- 17.2
32 Regulus - 1	9	58	149	33	34	48.2	12	53	30 N.	- 17.2
41 λ Hydra - 4	10	1	150	19	54	43.9	11	25	.6 S.	+ 17.4
33 λ Urfa Major 3.4	10	6	151	23	47	55.3	43	51	30 N.	- 17.6
36 ζ Leo - 3	10	6	151	31	29	50.4	24	21	36 N.	- 17.6
q^1 Argo Navis 4	10	7	151	41	33	37.6	41	10	53 S.	+ 18.0
41 γ Leo - 3	10	9	152	22	10	50.0	20	47	52 N.	- 17.7
34 μ Urfa Major 3	10	11	152	44	23	54.1	42	27	2 N.	- 17.8
42 μ Hydra - 4	10	17	154	13	33	43.5	15	52	6 S.	+ 18.0
47 ρ Leo - 4	10	23	155	41	54	47.4	10	16	58 N.	- 18.2
37 Leo Minor 3	10	28	156	59	56	51.1	32	57	34 N.	- 18.5
4 ν Hydra and C. -	10	40	160	3	48	44.2	15	12	10 S.	+ 18.8

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Names and Magnitudes of the Stars.	Mean Right Ascension, Jan. 1, 1810.			Annual Variation.	Mean Declination, Jan. 1, 1810.			Annual Variation.
	H.	M.	D. M. S.		D.	M.	S.	
54 Leo - 4.5	10	45	161 19 32	49.2	25	45	39 N.	- 19.0
48 β Urfa Major - 2	10	50	162 34 26	55.7	57	23	53 N.	- 19.1
7 α Hydra and C. - 4	10	51	162 37 58	44.1	17	17	15 S.	+ 19.1
50 α Urfa Major - 2	10	52	162 58 26	57.3	62	46	25 N.	- 19.3
63 χ Leo - 4.5	10	55	163 48 13	46.8	8	21	45 N.	- 19.2
52 ↓ Urfa Major 3.4	10	59	164 43 58	51.4	45	31	43 N.	- 19.3
11 β Hydra and C. 3.4	11	2	165 34 51	43.9	21	47	20 S.	+ 19.4
68 δ Leo - 2.3	11	4	165 59 45	48.2	21	33	47 N.	- 19.6
70 θ Leo - 3	11	4	166 3 49	47.4	16	28	3 N.	- 19.4
74 φ Leo - 4	11	7	166 45 7	45.8	2	36	49 S.	+ 19.5
53 ξ Urfa Major - 4	11	8	167 0 14	48.8	32	35	57 N.	- 19.5
54 ν Urfa Major - 4	11	8	167 2 47	49.1	34	7	45 N.	- 19.5
12 δ Hydra and C. - 4	11	10	167 27 42	44.9	13	45	5 S.	+ 19.5
77 σ Leo - 4.5	11	11	167 50 0	46.5	7	4	11 N.	- 19.6
78 ι Leo - 4	11	14	168 30 6	46.8	11	34	34 N.	- 19.6
14 ε Hydra and C. - 4	11	15	168 45 18	45.3	9	49	3 S.	+ 19.6
15 γ Hydra and C. - 4	11	15	168 50 58	44.8	16	38	26 S.	+ 19.6
84 τ Leo - 4	11	18	169 32 25	46.3	3	54	6 N.	- 19.7
1 λ Draco - 3.4	11	20	169 59 50	55.9	70	22	43 N.	- 19.7
87 ε Leo - 4.5	11	21	170 9 9	45.8	1	57	14 S.	+ 19.7
19 ξ Hydra and C. 3.4	11	24	170 55 13	44.0	30	48	20 S.	+ 19.8
21 θ Hydra and C. 4	11	27	171 45 42	45.5	8	45	2 S.	+ 19.8
91 υ Leo - 4	11	27	171 48 17	46.0	0	13	28 N.	- 19.9
27 ζ Hydra and C. 4	11	35	173 47 8	45.4	17	17	40 S.	+ 19.9
63 χ Urfa Major 4	11	36	173 59 31	48.4	48	49	59 N.	- 19.9
3 ν Virgo - 4	11	36	174 1 17	46.2	7	35	46 N.	- 19.9
93 Leo - 4	11	38	174 32 35	46.7	21	16	31 N.	- 19.9
94 β Leo - 2	11	39	174 50 21	46.0	15	38	4 N.	- 20.0
5 β Virgo - 3	11	41	175 11 54	46.9	2	50	8 N.	- 20.0
28 β Hydra and C. 4	11	43	175 49 56	45.0	32	51	2 S.	+ 20.0
64 γ Urfa Major - 2	11	44	175 56 38	48.1	54	45	3 N.	- 20.0
30 η Hydra and C. 4	11	46	176 35 11	45.6	16	5	30 S.	+ 20.0
1 α Corvus - 4	11	59	179 39 29	45.8	23	40	3 S.	+ 20.0
2 ε Corvus - 3.4	12	0	180 5 35	45.9	21	33	44 S.	+ 20.0
69 δ Urfa Major - 3	12	6	181 29 22	45.2	58	5	20 N.	- 20.0
4 γ Corvus - 4	12	6	181 30 46	46.1	16	29	4 S.	+ 20.0
15 η Virgo - 3.4	12	10	182 32 50	46.0	0	23	27 N.	- 20.0
16 ε Virgo - 3.4	12	11	182 40 34	55.9	4	22	27 N.	- 20.0
7 δ Corvus - 3.4	12	20	185 0 44	46.4	15	27	17 S.	+ 20.0
9 β Corvus - 3	12	24	186 6 26	46.8	22	20	35 S.	+ 19.9
5 κ Draco - 3	12	25	186 19 41	39.7	70	50	15 N.	- 19.9
23 K Chevel - 4	12	25	186 20 31	45.0	23	40	41 N.	- 19.9
29 γ Virgo - 3	12	32	188 0 30	45.3	0	24	19 S.	+ 19.9
77 ε Urfa Major - 2	12	46	191 24 23	39.9	56	59	36 N.	- 19.6
43 δ Virgo - 3	12	46	191 30 36	45.6	4	26	5 N.	- 19.6
12 Cor Caroli - 3	12	47	191 46 50	42.7	39	20	50 N.	- 19.6
47 ε Virgo - 3	12	53	193 10 48	45.0	11	59	3 N.	- 19.5
51 θ Virgo - 3.4	13	0	195 1 47	46.3	4	31	14 S.	+ 19.4
53 Virgo - 4.5	13	2	195 29 25	47.4	15	9	59 S.	+ 19.3
61 Virgo - 4.5	13	8	197 7 28	47.7	17	14	39 S.	- 19.2
2 γ Con. Hyd. - 3	13	9	197 9 10	48.3	22	9	50 S.	+ 19.2
ι Centaurus - 3	13	10	197 29 19	50.2	35	42	12 S.	+ 19.1
67 α Virgo - 1	13	15	198 47 58	47.2	10	9	53 S.	+ 19.0
79 ζ Urfa Major - 2	13	16	199 3 49	36.3	55	55	19 N.	- 18.9
79 ζ Virgo - 3	13	25	201 15 20	46.0	0	22	48 N.	- 18.7

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	H.	M.	D.	M.	S.		D.	M.	S.	
v Centaurus - 4	13	38	204	32	24	53.1	40	43	59 S.	+ 18.2
4 τ Charles's Wain 4	13	38	204	33	29	43.2	18	24	33 N.	- 18.2
2 G Centaurus - 4	13	38	204	37	10	51.4	33	29	41 S.	+ 18.2
85 η Urfa Major - 2	13	40	205	0	26	35.4	50	15	57 N.	- 18.2
5 υ Ch. Wain - 4	13	40	205	4	38	43.2	16	44	42 N.	- 18.2
8 η Ch. Wain - 3	13	46	206	24	31	42.9	19	31	17 N.	- 18.4
5 θ Centaurus - 2.3	13	56	208	53	15	52.3	35	25	40 S.	+ 18.0
11 α Draco - 3	13	59	209	48	40	24.3	65	17	14 N.	- 17.4
98 x Virgo - 4	14	3	210	41	38	47.6	9	22	58 S.	+ 17.2
99 i Virgo - 4	14	6	211	30	56	46.9	5	5	3 S.	+ 17.1
17 x Ch. Wain - 4	14	7	211	39	56	32.2	52	41	0 N.	- 17.1
18 Arcturus - 1	14	7	211	44	56	40.9	20	10	38 N.	- 19.0
100 λ Virgo - 4	14	9	212	12	39	48.3	12	29	17 S.	+ 17.0
19 λ Ch. Wain - 4	14	9	212	17	25	34.5	46	57	55 N.	- 17.0
21 i Ch. Wain - 4	14	9	212	21	31	32.2	52	14	54 N.	- 16.9
105 φ Virgo - 4	14	18	214	36	24	46.2	1	22	5 S.	+ 16.5
23 θ Ch. Wain - 4	14	19	214	41	3	31.0	52	44	5 N.	- 16.5
25 ρ Ch. Wain - 4	14	24	215	54	37	38.8	31	12	41 N.	- 16.2
27 γ Ch. Wain - 3	14	24	216	6	20	36.3	39	8	41 N.	- 16.2
5 a Urfa Minor - 4	14	28	217	1	33	- 4.7	76	32	30 N.	- 16.0
29 π Ch. Wain - 3.4	14	32	217	57	0	42.1	17	14	26 N.	- 15.8
30 ζ Ch. Wain - 3	14	32	218	1	7	42.7	14	33	5 N.	- 15.8
107 μ Virgo - 4	14	33	218	15	49	46.9	4	49	20 S.	+ 15.8
109 Virgo - 4	14	37	219	9	45	45.3	2	42	6 N.	- 15.6
36 ε Ch. Wain - 3	14	37	219	10	18	39.2	27	52	54 N.	- 15.6
9 α ² Libra - 2.3	14	40	220	5	48	49.5	15	14	39 S.	+ 15.3
37 ξ Ch. Wain - 4	14	43	220	39	21	41.2	19	53	51 N.	- 15.2
19 δ Libra - 4	14	51	222	42	36	47.8	7	45	17 S.	+ 14.8
7 β Urfa Minor - 3	14	51	222	51	10	- 4.8	74	56	0 N.	- 14.7
20 γ Libra or Sagit. 3.4	14	53	223	14	37	52.2	24	31	29 S.	+ 14.6
42 β Ch. Wain - 3	14	55	223	41	53	33.8	41	8	49 N.	- 14.5
24 i Libra - 4	15	1	225	21	10	50.8	19	3	41 S.	+ 14.1
27 β Libra - 2.3	15	7	226	41	55	48.0	8	40	19 S.	+ 13.8
49 δ Ch. Wain - 3	15	8	226	57	34	36.1	34	1	55 N.	+ 13.7
δ Lupus - 4	15	9	227	14	10	58.2	39	56	52 S.	+ 13.6
31 ε Libra - 4	15	14	228	28	47	48.4	9	37	44 S.	+ 13.3
51 μ Ch. Wain - 4	15	17	229	19	48	34.0	38	3	3 N.	- 13.1
11 Urfa Minor - 4	15	17	229	20	3	- 2.4	72	30	50 N.	- 13.1
3 β Corona - 4	15	20	230	0	1	37.2	29	46	5 N.	- 12.9
12 i Draco - 3.4	15	21	230	10	57	19.6	59	38	7 N.	- 12.8
13 γ Urfa Minor - 3	15	21	230	16	55	- 3.1	72	30	36 N.	- 12.8
35 ζ ¹ Libra - 4	15	22	230	33	5	50.4	16	11	50 S.	+ 12.8
γ Lupus - 3	15	23	230	37	48	59.1	40	30	54 S.	+ 12.8
38 γ Libra - 3.4	15	25	231	13	43	49.8	14	8	42 S.	+ 12.6
39 Libra - 4	15	26	231	22	43	54.0	27	29	41 S.	+ 12.5
13 δ Serpens - 3	15	26	231	25	57	42.8	11	11	0 N.	- 12.5
5 α Cor. B. - 2.3	15	27	231	39	40	38.2	27	21	42 N.	- 12.5
40 Libra - 4	15	27	231	45	13	54.7	29	8	28 S.	+ 12.4
43 x Libra - 4	15	31	232	45	17	51.5	19	3	5 S.	+ 12.2
7 ζ Corona - 4	15	32	233	3	25	33.8	37	15	41 N.	- 12.1
44 η Libra - 4	15	33	233	21	3	50.3	15	3	22 S.	+ 12.0
8 γ Corona - 4	15	35	233	41	33	37.7	26	54	21 N.	- 11.9
24 α Serpens - 2.3	15	35	233	43	44	44.2	7	1	55 N.	- 11.9
27 λ Serpens - 4	15	37	234	18	28	43.6	7	57	25 N.	- 11.7
28 β Serpens - 3	15	37	234	21	17	41.3	16	0	32 N.	- 11.7

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	H.	M.	D. M. S.		D.	M.	S.	
32 μ Serpens - 4	15	40	234 55 44	46.7	2	50	17 S.	+ 11.5
35 κ Serpens - 4	15	40	235 2 53	40.4	18	44	18 N.	- 11.5
37 ϵ Serpens - 3.4	15	41	235 20 13	44.5	5	3	31 N.	- 11.4
10 δ Corona - 4	15	42	235 24 29	37.7	26	39	32 N.	- 11.4
45 λ Libra - 4	15	42	235 34 46	51.8	19	35	15 S.	+ 11.4
38 ρ Serpens - 4	15	43	235 43 53	39.5	21	33	30 N.	- 11.3
46 θ Libra - 4	15	43	235 45 18	50.7	16	9	40 S.	+ 11.3
5 ρ Scorpio - 4	15	45	236 17 36	55.0	28	38	50 S.	+ 11.2
6 π Scorpio - 4	15	47	236 50 41	53.9	25	33	19 S.	+ 11.0
η Lupus - 4	15	47	236 53 25	58.8	37	50	24 S.	+ 11.0
48 \downarrow Libra - 4	15	47	236 53 28	50.0	13	43	12 S.	+ 11.0
41 γ Serpens - 3	15	47	236 55 11	41.0	16	17	51 N.	- 11.0
7 δ Scorpio - 3	15	49	237 16 46	52.7	22	4	8 S.	+ 10.9
16 ζ Urfa Minor - 4	15	51	237 46 58	- 36.8	78	22	22 N.	+ 10.6
51 ξ^3 Libra - 4	15	54	238 28 59	49.2	10	50	15 S.	+ 10.5
44 π Serpens - 4	15	54	238 31 38	38.6	23	20	27 N.	- 10.5
8 β Scorpio - 2	15	54	238 36 7	52.0	19	16	27 S.	+ 10.5
9 ω^1 Scorpio - 5	15	56	238 55 40	52.2	20	8	33 S.	+ 10.4
13 θ Draco - 3.4	15	58	239 35 26	17.1	59	4	31 N.	- 10.2
14 ν Scorpio - 4	16	1	240 14 32	51.9	18	57	19 S.	+ 10.0
1 δ Ophiuchus - 3	16	4	241 5 57	47.0	3	11	40 S.	+ 9.7
18 Scorpio - 4	16	5	241 19 31	48.3	7	51	11 S.	+ 9.6
2 ϵ Ophiuchus - 3	16	8	242 4 9	47.3	4	13	8 S.	+ 9.4
20 σ Scorpio - 4	16	10	242 24 53	54.2	25	7	27 S.	+ 9.3
20 γ Hercules - 3	16	14	243 23 5	39.6	19	36	32 N.	- 9.0
22 τ Hercules - 4	16	14	243 30 32	26.8	46	46	9 N.	- 9.0
Antares - 1	16	18	244 26 36	54.9	25	59	54 S.	+ 8.7
8 ϕ Ophiuchus - 4	16	20	245 4 10	51.2	16	11	10 S.	+ 8.5
10 λ Ophiuchus - 4	16	21	245 20 5	45.2	2	24	39 N.	- 8.4
14 η Draco - 3.4	16	21	245 21 25	11.8	61	56	50 N.	- 8.2
27 β Hercules - 3	16	22	245 30 47	38.7	21	54	42 N.	- 8.3
29 b Hercules - 4	16	24	245 55 55	42.1	11	54	24 N.	- 8.2
23 τ Scorpio - 3.4	16	24	246 1 6	55.6	27	48	29 S.	+ 8.2
13 ζ Ophiuchus - 2.3	16	27	246 40 36	49.3	10	10	17 S.	+ 8.0
35 σ Hercules - 4	16	28	246 59 46	28.9	42	50	8 N.	- 7.9
15 Δ Draco - 4	16	28	247 6 15	- 2.6	69	10	47 N.	- 7.8
40 ζ Hercules - 3.4	16	34	248 31 48	33.8	31	57	16 N.	- 7.0
44 η Hercules - 3.4	16	36	249 5 40	30.6	39	17	27 N.	- 7.2
26 ϵ Scorpio - 3	16	38	249 28 17	58.5	33	56	0 S.	+ 7.1
μ^1 Scorpio - 3	16	39	249 45 18	60.4	37	42	23 S.	+ 7.0
μ^2 Scorpio - 4	16	39	249 52 19	60.4	37	40	43 S.	+ 7.0
25 ι Ophiuchus - 4	16	45	251 15 22	42.4	10	29	22 N.	- 6.5
27 κ Ophiuchus - 4	16	49	252 10 17	42.7	9	40	52 N.	- 6.2
58 ϵ Hercules - 3	16	53	253 15 18	34.4	31	12	50 N.	- 5.8
35 η Ophiuchus - 3	16	59	254 52 23	51.4	15	28	41 S.	+ 5.3
22 ϵ Urfa Minor - 4	17	6	256 28 5	- 99.0	82	19	51 N.	- 4.6
64 α Hercules - 3	17	6	256 29 49	41.0	14	37	1 N.	- 4.6
65 δ Hercules - 3	17	7	256 48 26	36.8	25	4	24 N.	- 4.6
22 ζ Draco - 4	17	8	257 3 58	2.2	65	56	58 N.	- 4.5
67 π Hercules - 3.4	17	8	257 6 33	31.2	37	1	52 N.	- 4.5
40 ρ Ophiuchus - 4	17	10	257 24 13	53.4	20	53	40 S.	+ 4.4
53 ν Serpens - 4	17	10	257 32 11	50.3	12	38	29 S.	+ 4.4
42 θ Ophiuchus - 4	17	10	257 35 15	55.1	24	47	48 S.	+ 4.4
70 Hercules - 4	17	13	258 16 11	36.9	24	41	54 N.	- 4.1
75 ρ Hercules - 4	17	17	259 17 4	30.9	37	19	46 N.	- 3.8

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	H. M.	D. M. S.	D. M. S.		D. M. S.			
34 ν Scorpio - 4	17 18	259 27 53		60.8	37 7 43 S.		+ 3.7	
35 λ Scorpio - 3	17 21	260 10 41		60.7	36 56 59 S.		+ 3.5	
55 α Ophiuchus - 2	17 26	261 31 44		41.6	12 42 32 N.		- 3.0	
23 β Draco - 3	17 26	261 32 13		20.1	52 26 50 N.		- 3.0	
55 ξ Serpens - 4	17 27	261 40 41		51.3	15 15 57 S.		+ 3.0	
57 μ Ophiuchus - 4	17 28	261 52 50		48.7	7 59 26 S.		+ 2.9	
24 ν^1 Draco - 4	17 28	262 6 39		17.2	55 19 7 N.		- 2.8	
25 ν^2 Draco - 4	17 29	262 7 57		17.3	55 18 25 N.		- 2.8	
\times Scorpio - 3	17 29	262 20 19		62.1	38 55 1 S.		+ 2.7	
85 Hercules - 4	17 34	263 31 35		25.3	46 6 52 N.		- 2.3	
60 β Ophiuchus - 4	17 34	263 31 20		44.4	4 39 24 N.		- 2.3	
1462 ι Scorpio - 3	17 34	263 34 29		62.6	40 2 14 S.		+ 2.3	
γ Telescopium - 4	17 37	264 13 57		60.9	36 57 59 S.		+ 2.1	
28 ω Draco - 4	17 38	264 31 7	- 5.6		68 50 40 N.		- 1.9	
62 γ Ophiuchus - 3	17 38	264 35 32		45.1	2 47 23 N.		- 2.0	
86 μ Hercules - 3.4	17 39	264 45 0		35.4	27 50 40 N.		- 1.9	
64 ν Ophiuchus - 4	17 49	267 8 32		49.3	9 44 10 S.		+ 1.1	
91 θ Hercules - 3	17 50	267 26 5		30.7	37 16 58 N.		+ 0.9	
32 ξ Draco - 3	17 50	267 33 52		16.2	56 54 20 N.		- 0.9	
92 ξ Hercules - 4	17 50	267 35 47		34.7	29 16 36 N.		- 0.9	
57 ζ Serpens - 4	17 50	267 36 41		47.2	3 39 56 S.		+ 0.9	
67 σ^1 Ophiuchus - 4	17 51	267 47 0		44.9	2 57 10 N.		- 0.8	
68 K Ophiuchus - 4	17 52	268 1 46		4.5	1 19 15 N.		- 0.7	
33 γ Draco - 3	17 52	268 2 51		20.4	51 30 58 N.		- 0.8	
γ^1 Sagittarius - 4	17 53	268 13 16		57.3	29 34 27 S.		+ 0.7	
95 Hercules - 4	17 53	268 21 43		38.0	21 36 25 N.		+ 0.6	
10 γ^2 Sagittarius - 3.4	17 54	268 24 6		57.7	30 24 39 S.		+ 0.6	
70 P Ophiuchus - 4	17 56	268 57 50		45.0	2 33 40 N.		- 0.4	
34 \downarrow^2 Draco - 4.5	17 58	269 37 23	- 15.8		72 1 15 N.		- 0.1	
103 \circ Hercules - 4	18 0	270 2 0		35.0	28 44 44 N.		- 0.0	
13 μ^1 Sagittarius - 4	18 2	270 36 1		53.8	21 5 45 S.		- 0.2	
β Telescopium - 4	18 5	271 11 37		60.9	36 48 10 S.		- 0.4	
19 δ Sagittarius - 3	18 9	272 12 26		57.6	29 53 44 S.		- 0.7	
58 n Serpens - 3.4	18 11	272 52 13		46.4	2 56 14 S.		- 0.3	
20 ϵ Sagittarius - 2.3	18 12	272 53 27		59.6	34 27 32 S.		- 0.9	
109 Hercules - 4	18 16	273 54 1		38.0	21 41 45 N.		+ 1.3	
22 λ Sagittarius - 4	18 16	274 3 40		55.5	25 30 49 S.		- 1.2	
44 χ Draco - 4	18 24	276 6 22	- 17.8		72 39 2 N.		+ 2.2	
$1 m$ Aquila - 4	18 25	276 13 3		48.9	8 21 45 S.		- 2.1	
3 α Lyra - 1	18 31	277 37 35		30.4	38 36 50 N.		+ 2.9	
23 δ Ursa Minor - 4	18 34	278 23 31	- 282.2		86 34 16 N.		+ 3.2	
27 \circ Sagittarius - 4	18 34	278 26 41		56.2	27 10 21 S.		- 2.9	
6 l Aquila - 4	18 37	279 16 22		47.6	4 56 22 S.		- 3.2	
111 Hercules - 4	18 38	279 39 26		39.5	17 58 48 N.		+ 3.3	
10 β Lyra - 2.3	18 43	280 45 56		33.2	33 8 58 N.		+ 3.6	
34 σ Sagittarius - 2.3	18 43	280 52 11		55.9	26 31 10 S.		- 3.6	
63 θ^1 Serpens - 3.4	18 47	281 41 36		44.6	3 58 0 N.		+ 4.0	
12 δ^1 Lyra - 3.4	18 48	281 57 54		31.3	36 39 52 N.		+ 4.1	
47 \circ Draco - 4	18 48	282 5 49		13.1	59 9 34 N.		+ 4.2	
38 ζ Sagittarius - 3	18 51	282 37 44		57.4	30 8 19 S.		- 4.3	
13 ϵ Aquila - 3.4	18 51	282 44 56		40.8	14 49 18 N.		+ 4.4	
12 i Aquila - 4	18 52	282 52 57		48.0	5 59 39 S.		- 4.4	
14 γ Lyra - 4	18 52	282 57 29		33.6	32 26 11 N.		+ 4.4	
50 Draco - 4.5	18 52	283 6 12	- 27.8		75 12 10 N.		+ 4.6	
39 \circ Sagittarius - 4	18 53	283 19 23		53.8	22 0 22 S.		- 4.6	

STARS.

Names and Magnitudes of the Stars.	Mean Right Ascension, Jan. 1, 1810.					Annual Variation.	Mean Declination, Jan. 1, 1810.			Annual Variation.
	H.	M.	D.	M.	S.		D.	M.	S.	
40 τ Sagittarius - 4	18	55	283	46	5	56.3	27	56	0 S.	- 4.7
16 λ Aquila - 3.4	18	56	284	2	26	47.7	5	9	18 S.	- 4.8
52 ν Draco - 4.5	18	57	284	9	57	- 10.5	71	2	29 N.	+ 4.9
17 ζ Aquila - 3.4	18	57	284	10	8	41.3	13	35	28 N.	+ 4.8
41 π Sagittarius - 3	18	58	284	36	52	53.5	21	18	49 S.	- 4.9
57 δ Draco - 3	19	12	288	7	3	0.6	67	19	39 N.	+ 6.3
1 κ Cygnus - 4	19	13	288	10	33	20.7	53	1	21 N.	+ 6.2
30 δ Aquila - 3	19	16	288	58	43	45.3	2	44	47 N.	+ 6.5
60 τ Draco - 4.5	19	19	289	47	2	- 15.6	72	59	56 N.	+ 6.8
58 π Draco - 4	19	20	289	55	5	+ 9	65	21	0 N.	+ 6.8
6 Vulpecula - 4	19	21	290	11	57	37.4	24	17	23 N.	+ 6.9
6 β Cygnus - 3	19	23	290	45	52	36.2	27	34	6 N.	+ 7.0
38 μ Aquila - 4	19	25	291	12	2	43.6	6	59	14 N.	+ 7.2
39 κ Aquila - 3.4	19	27	291	39	58	48.4	7	26	19 S.	- 7.4
41 ι Aquila - 3.4	19	27	291	43	23	46.6	1	41	50 S.	- 7.4
13 θ Cygnus - 4	19	31	292	50	9	24.1	49	47	9 N.	+ 7.8
5 α Sagitta - 4	19	32	292	54	1	40.2	17	35	11 N.	+ 7.8
6 β Sagitta - 4	19	33	293	7	41	40.3	17	2	42 N.	+ 7.8
61 σ Draco - 4.5	19	33	293	10	9	- 2.8	69	20	48 N.	+ 7.9
50 γ Aquila - 3	19	37	294	18	22	42.7	10	9	34 N.	+ 8.3
18 δ Cygnus - 3	19	39	294	45	28	28.0	44	40	25 N.	+ 8.4
53 α Aquila - 1.2	19	42	295	22	38	43.9	8	22	35 N.	+ 8.9
55 η Aquila - 3	19	43	295	41	50	45.8	0	31	43 N.	+ 8.6
60 β Aquila - 3	19	46	296	29	39	44.2	5	56	29 N.	+ 8.6
12 γ Sagitta - 4	19	50	297	34	33	39.8	18	59	6 N.	+ 9.2
65 θ Aquila - 3.4	20	2	300	22	31	46.5	1	22	31 S.	- 10.1
5 α' Capricornus 3.4	20	7	301	46	34	50.0	13	5	7 S.	- 10.6
30 α' Cygnus - 4	20	7	301	49	54	28.2	46	14	49 N.	+ 10.5
6 α' Capricornus 3	20	8	301	52	31	50.1	13	7	25 S.	- 10.6
9 β Capricornus - 3	20	10	302	34	52	50.7	15	22	16 S.	- 10.8
37 γ Cygnus - 3	20	15	303	51	7	32.2	39	39	16 N.	+ 11.2
41 ι Cygnus - 4	20	22	305	24	33	36.6	29	44	33 N.	+ 11.6
2 ϵ Delphinus - 4	20	24	306	2	0	43.0	10	39	59 N.	+ 11.7
4 ζ Delphinus - 4	20	26	306	36	21	41.9	14	1	41 N.	+ 11.9
71 Aquila - 4	20	29	307	7	48	46.4	1	45	33 S.	- 12.1
6 β Delphinus - 3	20	29	307	9	32	42.1	13	56	36 N.	+ 12.2
9 α Delphinus - 3	20	31	307	42	10	41.7	15	15	0 N.	+ 12.2
11 δ Delphinus - 3.4	20	35	308	38	46	41.9	14	24	5 N.	+ 12.5
50 α Cygnus - 2	20	35	308	44	18	30.6	44	36	25 N.	+ 12.6
2 ϵ Aquarius - 4	20	37	309	20	46	48.7	10	10	51 S.	- 12.7
12 γ Delphinus - 3.4	20	38	309	27	46	41.7	15	26	56 N.	+ 12.7
53 ϵ Cygnus - 3.4	20	39	309	37	51	36.3	33	15	56 N.	+ 13.2
54 λ Cygnus - 4	20	40	310	0	8	34.9	35	48	3 N.	+ 12.8
3 η Cepheus - 4	20	41	310	20	55	18.4	61	6	2 N.	+ 13.0
6 μ Aquarius - 4	20	42	310	35	57	48.5	9	41	9 S.	- 13.0
58 ν Cygnus - 4	20	50	312	31	21	33.4	40	26	30 N.	+ 13.5
62 ξ Cygnus - 4	20	58	314	30	23	32.5	43	10	30 N.	+ 14.0
5 γ Equuleus - 4	21	1	315	16	26	43.5	9	22	30 N.	+ 14.2
64 ζ Cygnus - 4	21	5	316	12	47	38.4	29	27	13 N.	+ 14.4
7 δ Equuleus - 4	21	5	316	18	24	43.7	9	14	47 N.	+ 14.4
8 α Equuleus - 3.4	21	6	316	34	47	44.9	4	28	13 N.	+ 14.5
65 τ Cygnus - 4	21	7	316	48	8	35.5	37	14	17 N.	+ 14.6
67 σ Cygnus - 4	21	10	317	29	22	35.2	38	36	12 N.	+ 14.7
1 ϵ Pegasus 4	21	13	318	19	29	41.4	18	59	54 N.	+ 14.9
10 β Equuleus - 4	21	13	318	21	51	44.5	6	0	24 N.	+ 14.9

STARS.

Names and Magnitudes of the Stars.	Mean Right Ascension, Jan. 1, 1810.					Annual Variation.	Mean Declination, Jan. 1, 1810.			Annual Variation.
	H.	M.	D.	M.	S.		D.	M.	S.	
5 α Cepheus - 3	21	14	318	30	25	21.6	61	46	58 N.	+ 14.9
34 ζ Capricornus - 4	21	16	318	56	56	51.5	23	13	31 S.	- 15.1
22 β Aquarius - 3	21	22	320	23	12	47.4	6	23	59 S.	- 15.3
8 β Cepheus - 3.4	21	26	321	32	17	12.3	69	43	40 N.	+ 15.7
39 ϵ Capricornus - 4	21	26	321	36	24	50.6	20	18	33 S.	- 15.7
73 ρ Cygnus - 4	21	27	321	42	37	33.6	44	45	23 N.	+ 15.7
40 γ Capricornus 3.4	21	30	322	23	12	50.1	17	30	49 S.	- 15.8
9 ϵ or μ Pifces A 4	21	34	323	23	45	54.0	33	53	3 S.	- 16.0
8 ϵ Pegafus - 3	21	35	323	42	47	44.2	9	0	38 N.	+ 16.2
80 π Cygnus - 4	21	35	323	50	24	31.7	50	19	37 N.	+ 16.2
78 μ Cygnus - 3.4	21	36	323	54	44	39.7	27	53	27 N.	+ 16.2
10 θ Pegafus - 4	21	36	324	0	41	40.5	24	46	41 N.	+ 16.2
49 δ Capricornus - 3	21	36	324	8	5	49.9	16	58	57 S.	- 16.2
10 θ Pifces A - 4	21	37	324	8	20	53.2	31	46	11 S.	- 16.2
γ Grus - 3	21	42	325	35	42	54.9	38	14	59 S.	- 16.5
34 α Aquarius - 3	21	56	329	0	16	46.2	1	14	13 S.	- 17.2
33 ϵ Aquarius - 4	21	56	329	2	24	48.7	14	47	3 S.	- 17.2
14 μ or ϵ Pifces A 4	21	57	329	18	53	52.9	33	54	30 S.	- 17.2
24 ϵ Pegafus - 4	21	58	329	32	29	41.3	24	25	22 N.	+ 17.2
26 θ Pegafus - 4	22	1	330	9	12	45.1	5	16	6 N.	+ 17.4
21 ζ Cepheus - 4.5	22	4	331	4	17	30.8	57	16	3 N.	+ 17.5
43 θ Aquarius - 4	22	7	331	41	57	47.5	8	43	28 S.	- 17.5
23 ϵ Cepheus - 4	22	8	332	0	35	31.7	56	5	57 N.	+ 17.7
48 γ Aquarius - 3	22	12	332	57	32	46.4	2	20	22 S.	- 17.9
52 π Aquarius - 4.5	22	16	333	53	36	45.9	0	25	8 N.	+ 18.0
55 ζ Aquarius - 4	22	19	334	45	37	46.2	0	59	17 S.	- 18.1
17 β Pifces A - 3	22	21	335	10	4	51.5	33	18	53 S.	- 18.2
5 Lacerta - 5	22	22	335	24	20	37.0	46	44	16 N.	+ 18.2
27 δ Cepheus - 4.5	22	22	335	32	4	32.9	57	26	43 N.	+ 18.2
7 Lacerta - 4	22	23	335	52	10	36.2	49	18	32 N.	+ 18.3
62 η Aquarius - 4	22	26	336	23	49	46.2	1	5	30 S.	- 18.4
18 ϵ Pifces A - 4	22	30	337	31	46	50.0	28	1	46 S.	- 18.5
42 ζ Pegafus - 3	22	32	337	59	49	44.7	9	50	38 N.	+ 18.6
44 η Pegafus - 3	22	34	338	31	35	41.9	29	13	53 N.	+ 18.7
47 λ Pegafus - 4	22	37	339	20	50	43.0	22	34	12 N.	+ 18.7
48 μ Pegafus - 4	22	41	340	12	33	43.0	23	36	6 N.	+ 18.8
73 λ Aquarius - 4	22	43	340	40	26	46.9	8	35	9 S.	- 18.9
32 ϵ Cepheus - 4	22	43	340	44	14	31.6	65	12	12 N.	+ 18.9
76 δ Aquarius - 3	22	45	341	8	18	47.9	16	49	38 S.	- 18.9
Fomalhaut - 1	22	47	341	46	51	50.1	30	37	34 S.	- 18.9
1 \circ Andromeda - 3.4	22	53	343	18	3	40.8	41	18	28 N.	+ 19.2
53 β Pegafus - 2	22	54	343	38	31	43.4	27	3	21 N.	+ 19.4
4 β Pifces - 4	22	54	343	33	5	45.6	2	48	3 N.	+ 19.2
54 α Pegafus - 2	22	55	343	49	30	44.6	14	11	9 N.	+ 19.2
88 ϵ Aquarius - 4	22	59	344	49	27	48.1	22	11	59 S.	- 19.3
90 ϕ Aquarius - 4.5	23	4	346	7	8	46.5	7	4	6 S.	- 19.4
6 γ Pifces - 4	23	7	346	49	31	45.8	2	14	50 N.	+ 19.5
16 λ Andromeda - 4	23	28	352	4	25	43.1	45	25	55 N.	+ 19.8
17 ϵ Andromeda - 4	23	29	352	12	43	43.4	42	13	3 N.	+ 19.8
19 κ Andromeda - 4	23	31	352	46	11	43.5	43	16	58 N.	+ 19.9
35 γ Cepheus - 3	23	32	352	54	53	35.5	76	34	16 N.	+ 19.9
29 Pifces - 5	23	52	358	1	14	46.0	4	5	1 S.	- 20.0
33 Pifces - 4	23	56	358	54	6	46.0	6	46	10 S.	- 20.0
21 α Andromeda 2.3	23	59	359	38	48	46.0	28	2	28 N.	+ 20.0
11 β Calliopeia - 2.3	23	59	359	46	32	46.8	58	6	4 N.	+ 19.8

To learn to know the several fixed stars by the globe, see **GLOBE**.

The parallax and distance of the fixed stars, see under **PARALLAX** and **DISTANCE**.

STARS, Circumpolar. See **CIRCUMPOLAR**.

STAR, Falling, in *Meteorology*, a meteor, the explication of which has puzzled all philosophers, till our modern discoveries in electricity have led to the most probable account of it. Signor Beccaria makes it pretty evident, that it is an electrical appearance, and in proof of this position he recites the following fact. About an hour after sunset, he, and some friends that were with him, observed a falling star directing its course towards them, and apparently growing larger and larger, but it disappeared not far from them; when it left their faces, hauds, and clothes, with the earth, and all the neighbouring objects, suddenly illuminated with a diffused and lambent light, attended with no noise at all. During their surprize at this appearance, a servant informed them that he had seen a light shine suddenly in the garden, and especially upon the stream which he was throwing to water it. All these appearances were evidently electrical; and S. Beccaria was confirmed in his conjecture, that electricity was the cause of them, by the quantity of electric matter which he had seen gradually advancing towards his kite, which had very much the appearance of a falling star. Sometimes also he saw a kind of glory round the kite, which followed it when it changed its place, but left some light, for a small space of time, in the place which it had quitted. Priestl. Elect. vol. i. p. 434. 8vo. See **IGNIS Fatuus**.

STAR, Morning. See **MORNING**.

STAR, Place of a. See **PLACE**.

STAR, Pole. See **POLE**.

STARS, Twinkling of the. See **TWINKLING**.

STARS, Unformed. See **INFORMES**.

STAR, in Electricity, denotes the appearance of the electric matter on a point into which it enters. Beccaria supposes that the star is occasioned by the difficulty with which the electric fluid is extricated from the air, which is an electric. See **BRUSH**.

STAR, in Fortification, a little fort, with five or more points, or salient and re-entering angles, flanking one another, and their faces 90 or 100 feet long.

Formerly, star-forts were frequently made in lines of circumvallation, after two or three redoubts. See **REDOUBT** and **SCONCE**.

STAR, in Heraldry, denotes a charge frequently borne on the shield, and the honourable ordinaries, in the figure of a star. It differs from the mullet, or spur-rowel, in that it is not pierced as this last is.

It usually consists of five rays or spokes. When it has six or eight, as among the Germans and Italians, particular mention must be made of them in blazoning.

STARS, on Medals, are marks of consecration and deification, being intended as symbols of eternity. F. Joubert says, they sometimes express the children of princes reigning, and sometimes the children dead; and placed in the rank of deities.

STAR, in the Manege. *White stars in the forehead* are esteemed good marks in all horses, except white and grey ones: where nature fails to produce this good criterion, our jockies have frequently recourse to art. See **HORSE**.

The method of making stars, practised among the Dutch, is to roast a large onion in hot ashes, and when near thoroughly done, to divide it in two, and dip it in scalding hot walnut-oil. This done, they immediately apply the flat side of it to the place the star is to be on, and keep it there half an hour. After taking it off, they anoint the

scalded place with ointment of roses; in a short time, the scurf-skin falls off, and white hair grows up in its room; but the middle always continues bare of hair, which is the certain characteristic of an artificial star.

The method most used among us is to shave the hair from the place it is to be made on; then to apply a little oil of vitriol with a feather, or the like, passing it lightly over the bald place. This eats away the roots of the former hair, which will be succeeded by white. The fore is healed up with copperas, and green ointment.

STAR, To make a Black, on a white or other coloured horse, wash the place to be changed frequently with fern-roots and sage, boiled in ley; and they say it will breed black hairs. The same may be done by beating four milk, galls, and rust, together, and anointing the part with it.

STAR, A Red, is made with an ounce of aqua fortis, a penny-worth of aqua vitæ, and silver to the value of eighteen-pence, all heated together in a glass, and the place anointed with it. This immediately turns the hair to a perfect red; but it lasts no longer than till the horse casts his coat.

STAR, or Starr, Starrum, in our *Old Writers*. All the deeds, obligations, &c. of the Jews, were called *starra*, and writ for the most part in Hebrew alone, or in Hebrew and Latin; one of which yet remains in the treasury of the exchequer, written in Hebrew without points, the substance of which is expressed in Latin just under it, like an English condition under a Latin obligation: this bears date in the reign of king John; and many starrs, as well of grant and release, as obligatory and by way of mortgage, are pleaded and recited at large in the Plea Rolls.

Before the banishment of the Jews under Edward I., their contracts and obligations were denominated *starra*, or *starrs*; which, by an ordinance of Richard I., preserved by Hoveden, were commanded to be enrolled and deposited in chests, under three keys, in certain places; one and the most considerable of which was in the king's exchequer, at Westminster; and no *starr* was allowed to be valid, unless it were found in some of the said repositories.

The word *starr* is a contraction from the Hebrew *schetar*; a deed or contract.

STAR, in Pyrotechny, a composition of combustible matters; which being borne, or thrown aloft into the air, exhibits the appearance of a real star.

Stars are generally used as appendages to rockets, a number of them being usually enclosed in a conical cap, or cover, at the head of the rocket, and carried up with it to its utmost altitude, where the stars taking fire, are spread around, and exhibit an agreeable spectacle. For their composition, see **PYROTECHNY**.

STAR is also a badge of the orders of the Garter and Bath.

STAR, Order of the, or *Our Lady of the Star*, an order of knighthood, instituted by king John II. of France in the year 1351, in imitation of the order of the Garter, not many years before established in England by king Edward III., so denominated from a star they wore on the stomach.

At first there were but thirty knights; but the order, in time, became depreciated by the multitude of persons admitted without any distinction. For which reason Charles VII. when grand-matter thereof, quitted it, and gave it the chevalier de Guet, knight of the watch at Paris, and his archers; who still wear a star on their coats. But this account is contradicted by others; who will have the order instituted by king Robert, in 1022, in honour of the Holy Virgin, and to have fallen in disregard during the wars of Philip de Valois.

Others say, that Lewis XI. having instituted the order

of St. Michael, this order was abolished by his son Charles VIII.

The ensign of this order was the four capital letters M. R. A. V., embroidered in gold within a square on the left breast of the knight's garment; between the letters a mullet of eight points, the point in base wavy, and larger than the other; over the mullet a crown, composed of fleurs-de-lis and balls. The collar was three rows of gold chains; thereon roses enamelled white and red, and placed alternately.

Justiniani mentions another order of the Star, at Messina, in Sicily, called also the *order of the Crescent*. This was instituted in the year 1268, by Charles of Anjou, brother of St. Louis, king of the Two Sicilies.

According to others, this order was instituted in 1351, when the princes of the house of Anjou being driven out of the kingdom of Naples, and Sicily falling again under the dominion of the kings of Aragon, this order, it is said, was established in lieu of that of the Crescent, which was then abolished, as is this order also. The badge of the order was a star of eight points, surmounted with a mullet of eight points.

Others will have it instituted in 1464, by Renato, duke of Anjou, who took the title of king of Sicily. At least it appears, from the arms of this prince, that he made some alteration in the collar of the order; for, instead of fleurs-de-lis, and stars, he only bore two chains, whence hung a crescent, with the old French word *loz*; which, in the language of rebus, signified *loz in a crescent*.

The order, being sunk into obscurity, was raised again by the people of Messina, under the name of the "Noble Academy of the Knights of the Star," reducing the ancient collar to a single star, placed on a forked cross; and the number of knights to sixty-two. Their device was MONSTRANT REGIBUS ASTRA VIAM: which they expressed by

MR

the four initial letters * with the star in the middle.

AV

STAR, *Order of the Polar*. See POLAR.

STAR of Alexandria, in Botany. See ORNITHOGALUM.

STAR-Apple. See CHRYSOPHYLLUM.

STAR-Flower. See ORNITHOGALUM.

STAR-Hyacinth. See SCILLA.

STAR of Bethlehem. See ORNITHOGALUM.

STAR of the Earth, the name of a plant famous for its virtues in curing the bite of a mad dog. The original account of its nature and virtues seems to be this: king James sent to the Royal Society a dried specimen of a plant, which had been sent to him as the plant with which his dogs had been cured when bitten by a mad dog, and the name by which this was called was *star of the earth*.

This plant was so ill dried, that it was not easily distinguished; but at length Mr. Ray found it to be the *sesamoides salamanicum magnum*. It does not seem, however, clear, that this was the plant vulgarly known by that name, but rather that it was gathered by some ignorant person; neither the name star of the earth at all agreeing with it, nor any account having been given before of its having such virtues. Dr. Grey, in his Complete Farrier, greatly recommends the star of the earth in the cure of this bite, and the plant he means is plainly the coronopus, or buck's-horn-plantain; and, upon the whole, it seems that this last mentioned is the plant properly called by this name, as its virtues have always been celebrated even in this case, and its leaves always are disposed on the earth in the form of the rays of a star. It is to be added to this, that the countess of Suffolk's powder, so famous in many places for this terrible disease, and

by which several persons have been known to be cured, is principally composed of this plant. Phil. Trans. N^o 450. p. 155.

STAR-Fish called also the *Sea-star*, in *Ichthyology*, is the general name for the Linnæan genus *ASTERIAS*; under which term several species are enumerated without description. There are more than forty species, separated into sections, according as the individuals are lunate, stellate, or radiate.

A. Lunate.

Species.

NORLIS. Granulous, with a ridge round the margin, the disk of which is glabrous. It is found in the North seas.

PULVILLU. Lubricous, with an entire simple margin. This is found in the North seas. It is described as having a body convex above, covered with a smooth sanguineous skin transversely in particular parts; beset towards the margin with soft blunt white spines, about the size of a grain of millet-seed, and divided into ten areas; the margin is not articulate, but rough in the angles, with about ten acute papillæ; beneath, the body is concave, smooth, whitish, with a rosy tinge, and hollowed by five grooves each side, covered with horizontal batons. It tinges warm water with a tawny colour.

MILITARIS. Every where granulous, with a granulous margin. It is found in the North seas.

LUNA. Orbicular, entire. It inhabits India. The body is compressed, and every where sprinkled with raised dots.

B. Stellate.

* PAPPOSA. This species has from twelve to fourteen rays, the edges of which are surrounded with short fascicular processes; the surface is muricate. It inhabits the European and Asiatic seas. The body above is ferruginous, the disk spotted with white; the rays are paler at the ends; beneath whitish with paler papillæ and black grooves down the rays; the disk is tinged with red; the rays are from 11 to 15; it is lanceolate, and a little convex above.

SPONGIOSA. This species is roughish; with five femicylindrical obtuse rays, unarmed at the edges. It inhabits the Greenland seas, and is not three-quarters of an inch in diameter. The body is of a pale reddish, with a very minute and red central protuberance above, and rough, with minute crowded spines; the rays are inflexed at the edges.

* RUBENS. Lax, with five lanceolate, convex rays, covered above with single spines, disposed in rows. This is the *Asterias hispida* of Pennant. It inhabits the ocean, and is from nine to fourteen inches in diameter. The body above is red, pale orange, yellowish, cinereous or black, sometimes violet; it has from four to six rays, with four rows of papillæ beneath; the tubercles are sometimes scattered, or disposed in rows. In some of the individuals there are no prickles, and in some no bristles.

* SEPOSITA. With five round rays, reticulate beneath, and covered above with pectinate prickles. This is the *Asterias spinosa* of Pennant. It is very small, and found in the European seas.

ENDECA. With nine rays, every where covered with pectinate prickles. There is a variety of this species. It is found in the North seas; and the rays are from five to nine.

MINUTA. With six rays, the edges with distant, projecting, fascicular processes. It inhabits the Northern seas. The body is of a pale yellow; about two lines and a half in diameter; and flat on each side.

* **GLACIALIS.** With five angular rays, triangles with prickly protuberances. It inhabits the Ndh seas, and feeds on oysters. The rays are thick and lanolate. The body, when alive, is rufous, undulate with wlie, sometimes cinereous brown, or green; the disk above with tubercles disposed in a circle, beneath hollow: the tentacula are numerous, pellucid, with a row of small pinnules on each side; the back is marked with a round striate operculum or lid.

* **CLATHRATA.** With five short thick ray; hirsute beneath, and cancelled above. It inhabits the European seas; and is described and figured in Pennant's British Zoology.

ECHINITES. With twenty rays, each with two rows of suckers, and numerous large and small moveable spines. It inhabits Batavia. The disk as well as the rays are covered with small moveable spines.

RETICULATA. Rays four, reticulate with prickles. It is found in the Indian seas.

PHRYGIANA. This species is every where beset with papillæ, which are beneath of a rosy colour. It is found on the coasts of Norway.

NODOSA. With five convex rays, longitudinally elevated, and mucicate: it is met with on the coasts of the Indian seas.

* **VIOLACEA.** Lax, with a grey-brown surface, and violet tubercles; it has five rays. Inhabits the European and Northern seas. The body has sometimes a violet surface, and marked sometimes with violet tubercles only; these are either disposed in rows, or irregularly scattered; the disk is orbicular; the rays lanceolate and reddish at the tip; beneath yellowish in the grooves.

SANGUIOLENTA. Above sanguineous; the rays are tipped with white. It inhabits the North seas.

PERFORATA. Unarmed; with perforated dots on the back. This also is an inhabitant of the North seas.

ARANCIACA. Disk broad; rays five, sub-depressed, and prickly at the margins: in the Mediterranean and North seas.

* **EQUESTRIS.** Five rays; disk reticulate, and perforated with dots; tubercles five; margin sub-articulate; beneath a single row of tentacula: an European species.

LÆVIGATA. With five semi-cylindrical obtusely eight-angled, unarmed rays. It inhabits the Mediterranean and Indian seas. The rays are covered with obsolete warts, and between them, at the sides, are hollow dots; beneath, the warts are disposed in quincunx.

* **MEMBRANACEA.** With five broad membranaceous rays, extremely thin and flat. Inhabits the European and Mediterranean seas. The rays are rough, with tubercles; beneath with five elevated convex ribs.

GRANULOSA. Pentangular, unarmed, each side tessellate with granulations, the margin is jointed. It is found on the coasts of the island of Santa Cruz.

C. Radiate.

ROSEA. Rough, with reticulate granulations; rays round. This species is found in the Belgic and Norway seas, and is reckoned extremely elegant. Body above of a rich rose-colour, sometimes inclining to orange, with blackish dots between the granulations; beneath whitish, with dilated grooves; a quadruple row of tentaculæ, and five rows of divergent pinnules; rays white at the tip.

PERTUSA. Rough, rays round, with a narrow, gibbous base. This inhabits the North seas.

* **OPHIURA.** Disk scaly; scale of the angles serrate. It inhabits the ocean, is very small, and moves slowly. The body above is generally grey, reddish, or violet, rarely white; glabrous, with five rays; the disk is orbicular; the rays are four times as long as the body, slender, quadrangular, flexuous, and covered with a single row of scales. It

has been assumed, rather than proved, that the mischievous effects which at certain times of the year are produced by eating the common mussel, are occasioned by their having fed upon this species of asterias.

ACULEATA. With glabrous prickles; it is shorter than the diameter of the rays. It inhabits the ocean. It has five rays. The body varies in colour; it is in shape orbicular, with minute scales beneath, six of which resemble a corol.

CILIARIS. With rough spines, longer than the diameter of the rays. It inhabits the Indian and North seas.

* **SPILERULATA.** With five slender-jointed rays, hirsute on the sides; with a small globular head between the base of each ray. It inhabits the European seas. The body is pentangular, indented, smooth above the aperture, beneath it is five-pointed.

* **PENTAPHYLLA.** This species is known by five slender rays, hirsute at the sides, and tessellate above, and below green, sometimes with sky-blue. It inhabits the British coasts. The body is regularly pentangular.

* **VARIA.** With five hirsute rays, annulate with red; the body is circular, with ten radiate streaks; the ends are lozenge-form. This also is found on our own coasts, as are the four that follow.

* **ACULEARIS.** This species is known by its five slender, hirsute rays; the body is round, with alternately broad and narrow streaks from the centre.

* **HASTATA.** With five hirsute, jointed rays; the body is pentagonal and indented, brownish-red, with ten ochraceous streaks, five slender, with javelin-shaped extremities.

* **FISSA.** With five slender, hirsute rays; the body is circular, with five equidistant dents, penetrating deep into the sides, and five light-coloured streaks from the centre.

* **NIGRA.** This also has five hirsute olive rays, tessellate with deeper shades: the body is pentagonal, black, with five radiate streaks of white.

TENELLA. With ten pectinate rays above; and filiform ones beneath, which are thickened at the joints. It is found on the coasts of Santa Cruz. The body is white; the stem of the rays is longer.

* **PECTINATA.** With ten pectinate rays above, and fewer filiform ones beneath; the joints are equal; disk smooth above. It inhabits the European and Indian seas. The body is covered above with five unequal valves; the colour is of a deep red; the filiform rays beneath are terminated by an incurved claw.

MULTIRADIATA. This species has ten palmate, sub-quadrifid, pectinate rays above, and numerous filiform ones beneath; the disk is granulate: inhabits the Indian ocean.

* **CAPUT MEDUSÆ.** With five divided and sub-divided rays; disk and rays granulate; mouth depressed. This species inhabits most seas, and is an extremely curious sea-animal; the five rays dividing into two smaller ones, and each of these dividing again into two others; which mode of regular sub-division is continued to a vast extent, gradually decreasing in size, till at length the ramifications amount to many thousands, forming a beautiful net-work. Its colour is sometimes pale or reddish-white, sometimes brown.

EURYALI. Rays divided and sub-divided; disk papillous, and with the rays granulate; the mouth is a little raised. It inhabits the Cape of Good Hope.

OLIGETES. Rays very long and simple, with two acute moveable styles at each joint. Found near Curassoa, adhering to gorgoniæ. The body is pentangular, minute, ochraceous, and rather hard.

NIGRITA. With five jointed rays, covered with imbricate scales above, and lateral patulous ramifications; the disk is obtusely pentangular and granulate.

TRICOLOR. With five jointed rays, pectinate at the sides; the ramifications are rough; the disk is hispid. It is found on the coast of the Feroe islands.

FRAGILIS. Disk orbicular, muricate, spinous on the back: rays five, jointed and pectinate at the sides; the ramifications ferrato-muricate: found in the North seas.

The most frequent kind of star-fish is that which has five rays, which issue in the manner of so many vermiform, or worm-like processes: these therefore are called *stella vermiformes*, or the *worm-like* star-fish. Another kind, nearly approaching to the nature of these, has more than five rays, and from the sides of these other transverse processes are produced, which are covered with an extremely fine kind of down, or hairiness; these are called the *hairy* star-fish. A third kind is called the *astrophyta*, or *plant-like* star-fish: this is composed of a body from whence there arise a great number of branches, which divaricating more and more, are at length increased, or divided into a prodigious number; and these being cylindrical in figure, resemble very much the branches of plants. Several of the species of the star-fish are eatable, and some of them afford a very good nourishment. Some are prescribed by physicians as ingredients in plasters.

Every ray of the star-fish is furnished with so very large a number of legs, that they cover the whole surface: they are disposed in four ranges, each of which contains about seventy-four; so that the whole ray contains three hundred and four, and consequently the fish has, upon all five of its rays, no less than fifteen hundred and twenty legs. With all this numerous train of legs, however, the animal moves but very slowly; and indeed they are so soft and feeble, that they scarcely deserve the name of legs, and, more properly speaking, they are only a sort of horns, like those of our garden-snails, but they serve the animal to walk with, and are therefore called legs. Mem. Acad. Par. 1710.

The amazing property of reproducing the essential parts, when lost, extends to the star-fish. M. Reaumur, on the discovery of this property in the polype, observed these other animals, as they lay on the shores of Poitou and other places, and often found that species of star-fish which is very commonly known, and which has naturally five rays or arms, with only three or four, one or two being wanting; and on taking up and examining these mutilated ones, nature was always found reproducing the limb that was wanting; and on cutting and breaking other star-fish into several parts, it was but a very little while before the broken parts cicatrized, and every part remained alive. Phil. Transf. N° 464. Append.

The *arborescent* star-fish, *stella arborescens*, or *caput meduse* of Linnæus, is one of the curiosities of nature, found in several cabinets of natural rarities. See *MEDUSÆ Caput*, and *supra*. Grew, Mus. Reg. Societ. part i. sect. 5. cap. 4. p. 122.

This has been found in the north of Scotland, and on the coast of Cornwall. See *BASKET-Fish*.

STAR-Gazer, the English name of the uranoscopus.

STAR-Shot, the common name of a gelatinous substance often found lying on the surface of the earth, and called by some *star-jelly*, and *star-fallen*.

The vulgar have been always of opinion, that this was produced from that meteor which they call a falling-star; others have imagined it a vegetable substance, and supposed it grew out of the earth: but it is probably the half-digested food of herons, bitterns, crows, sea-mews, and caddy-moddies, principally when they have fed upon frogs or earth-worms.

The heads of frogs are found whole in masses of this matter, and also parts of worms: these birds, when shot,

disgorge a substance of the same kind. This is gelatinous, like a thick mucilage of gum tragacanth, and cold to the touch. In it are often yellow specks and small clots, like grumous blood. It smells like putrid flesh, when kept, and is principally found in misty mornings, and in wet weather, in autumn, winter, and spring. Moreton's Northampton, p. 353.

Mr. Boyle says, he has seen this jelly resolved, by digestion only, into a permanent liquor, and that a physician of his acquaintance extolled it as a specific, outwardly applied to wens. Works, Abr. vol. i. p. 310.

STAR-Shot, in *Artillery*, consists of four pieces of iron, whose bases, when separate, form the quadrant of a circle; so that the whole being joined forms a cylinder equal to the shot of the cannon. Each of these pieces is furnished with an iron bar, the extremity of which is attached to a sort of link, as keys are strung upon a ring. Being discharged from the gun, the four branches or arms extend every way from the link in the centre. These are used in the sea-service, and chiefly designed for destroying the sails and rigging; but their flight and execution are very precarious at any considerable distance.

STAR-Stone, *Asteria*, in *Natural History*, the name of a kind of extraneous fossil, of a very regular figure and structure, and approaching very much to the nature of the entrochi, having the same substance and inner structure, and being much of the same size, though different in form: it comprehends the *asteropodia* and the *appendiculæ*, or wires of the asteriæ. The asteriæ are by many affirmed to be the fossile radii of the star-fish of the decempede, or ten-rayed kind: others have thought that some species of them have been the remains of the common coriaceous kinds. The encrinos, or *lilium lapideum*, seems to be a part of one of the ten-rayed kinds; and the trochitæ, and entrochi, are plainly owing to the fragments of several of these kinds. Linkius, de Stellis Marin.

Mr. Ellis has particularly described, and illustrated by figures, fossils of this kind, as well as the animals or star-fish to which they belong; but as the stem of the animal, the specimen of which he examined, and from which his description is taken, was broke off short at the bottom, he is in doubt whether it moves about in the sea, or is fixed to rocks and shells by a base, like corals, sponges, and keratophytos. Phil. Transf. vol. lii. part i. art. 56.

The *asteropodia* (see *ASTEROPodium*), in substance and inner structure, agree perfectly with the shells of the echinitæ, found in our chalk-pits, and with the asteriæ and entrochi; these bodies being all composed of obliquely-arranged plates of a tabulated spar: the several parts of which they are composed are all convex on one side, and concave on the other; but they are of very different shapes, being sometimes roundish, sometimes oblong, often quadrangular, and not unfrequently of different numbers of angles. They have frequently two, sometimes more, ridges running across them, and sometimes they have tubercles, or small protuberances, standing either on their upper or under side: they are sometimes found single, but more frequently compound, or arranged into smaller or larger parcels, being placed over one another in the manner of the tiles of a house, and seem truly to have been originally part of an imbricated shell, or crust of some species of sea-fish. They are in these compound masses even very evidently fragments, and are usually of irregularly broken figures, though sometimes they resemble, in some degree, parts of the rays of one or other of the kinds of star-fish. They are usually found loose from the asteriæ, though lying among them; but sometimes the asteriæ are regularly fixed on them, just as

the entrochi on the modiola, and are plainly seen to have originally grown out of them.

The asteropodia seem properly the bases of the asteriæ, and the asteriæ themselves are branches of them. The asteriæ are short, and have commonly somewhat crooked angular columns, composed of several joints, each resembling the figure of a radiated star, with a greater or smaller number of rays in the different species: they are usually found of about an inch in length, and of the thickness of a goose-quill. Some of them have five angles or rays, and others only four, and in some the angles are equidistant, while in others they are irregularly so; in some also they are short and blunt, while in others they are long, narrow, and pointed; and some have their angles so very short and obtuse, that at first sight they may be taken for entrocho-asteriæ. The several joints in the same specimen are usually all of the same thickness; this, however, is not always the case, but in some they are larger at one end, and in others at the middle, than in any other part of the body; and some species have one of the rays bifid, so as to emulate the appearance of a six-rayed kind.

All the asteriæ are naturally fulcated between the angles, but this in a very different degree; some are very little so, while others are cut so deeply, that the single joints of them resemble the rowels of a spur. One end of the column is frequently found finely engraved along the edges of the angles, or rays, while the other end is smooth, or nearly so; and the same is often the case also in the single joints. Not unfrequently, also, one end of a column is indented, and the other has five striæ, running from a hollow centre to the fulci between the rays. They are found of various sizes and colours; the longest seldom arrive, however, at two inches; and they are found of all the intermediate bulk from this down to the length of a barley-corn: they are not unfrequently found, also, compressed and flattened, as is common to the fossils that have been formed in animal moulds.

They are usually bedded in strata of clay, though not unfrequently in those of a lax sort of quarry-stone, and sometimes in a harder. They usually have sea-shells, and other marine remains, lying about them; and sometimes these shells adhere to the asteriæ, and when separated from them, do no injury to the asteriæ, but themselves shew a mark of the figure of the body, or part of the column, when a part has been always wanting in the shell.

From the columns of the asteriæ there are sometimes propagated certain small branches, like those of the entrochi; these are called by authors *appendicule asteriarum*, or the wires of the asteriæ.

These are sometimes two inches long, and the largest or thickest joint always adheres to the alteria, all the succeeding ones growing smaller, and the branch more tapering toward the end. In their natural situation on the alteria, they stand in regular circles at different distances one above another: there is always one wire in each of the fulci, or channels of the body, and these stand evenly against one another.

These wires or appendiculæ are very seldom, however, found in this their native state, or fixed to the bodies of the asteriæ; they are commonly found broken off, and lying loose among them, either in fragments of different lengths, or in single joints, immersed in stone, or lying among the strata of clay.

The asteriæ may be reduced to two kinds; the first, those whose whole bodies make the form of a star; the second, those which in the whole are irregular, but which are adorned, as it were, with constellations in the parts.

Dr. Lister, for distinction sake, only gives the name *asteria* to the former sort, distinguishing the latter by the appellation of *astroites*; the other naturalists generally use the two indiscriminately. The asteria spoken of by the ancients appears to be of this latter kind.

The quality of moving in vinegar, as if animated, is scarcely perceivable in the astroites, but is signal in the asteria. The former must be broken in small pieces before it will move; but the latter will move, not only in a whole joint, but in two or three knit together. Plott, Nat. Hist. Oxford.

STAR-*Thistle*, in *Botany*. See *CENTAUREA Calcitropa*.

STAR-*Wort*. See *ASTER*.

STAR-*Wort*, *American*, or *Trailing*, of Vera Cruz. See *TRIDAX*.

STAR-*Wort*, *Basard*, a species of *Bupthalmum*; which see.

STAR-*Wort*, *Yellow*, a species of *Inula*; which see.

STAR-*Chamber*, *Court of*. See *COURT*.

STAR-*Fort*, or *Redoubt*, in *Fortification*. See *STAR*, *REDOUBT*; and *FORT*.

STARADI, in *Geography*, a town of Asiatic Turkey, in Natolia; 42 miles E. of Iznik.

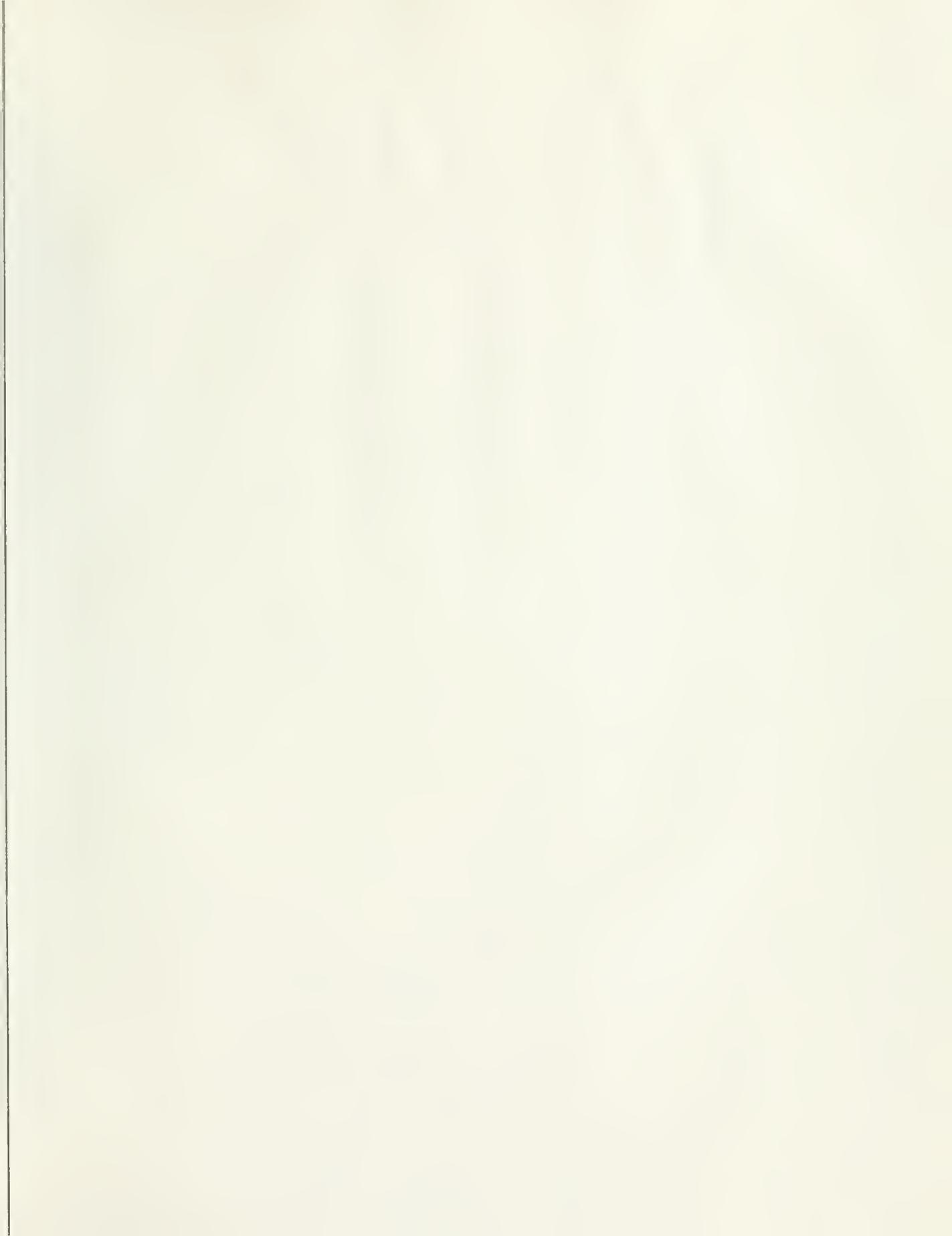
STARAPHAXAT, a name used by some of the old writers for any medicine that restrains fluxions from the eyes, nose, or fauces.

STARA-RUSA, in *Geography*, a town of Russia, in the government of Novgorod, near lake Ilmen; 56 miles S. of Novgorod. N. lat. 57° 40'. E. long. 31° 50'.

STARASELLA, a town of Italy; in Friuli; 8 miles N.E. of Friuli.

STARBOARD, in *Sea Language*, is the right-hand side of a ship, when looking forward from the stern.

END OF VOL. XXXIII.





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